HAZARDOUS WASTE RESEARCH AND INFORMATION CENTER
Illinois State Water Survey Division
1808 Woodfield Drive
Savoy, Illinois 61874

HWRIC RR-030

Historical Assessment of Hazardous Waste Management in Madison and St. Clair Counties, Illinois, 1890-1980

by

Craig E. Colten

with cartography by

Ted B. Samsel

Illinois State Museum

Springfield, Illinois 62706

Printed October 1988

ENR Illinois Department of Energy and Natural Resources

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List of Abbreviations

E&E - Ecology and Environment, Inc.
ESL - East St. Louis
ESL&SD - East Side Levee and Sanitary District
FWP - Federal Writers' Project Manuscripts, Illinois State Historical Library, Springfield, Illinois
HWRIC - Hazardous Waste Research and Information Center
IDPH - Illinois Department of Public Health
IEPA - Illinois Environmental Protection Agency
ISA - Illinois State Archives, Springfield, Illinois
ISGS - Illinois State Geological Survey
ISHD - Illinois State Health Department
ISWB - Illinois Sanitary Water Board
ISWS - Illinois State Water Survey
NRC - National Resources Committee
MCCC - Madison County Circuit Court Records
MCS - Madison County Sesquicentennial Committee
NYDEC - New York Department of Environmental Conservation
RCRA - Resource Conservation and Recovery Act
SCCCC - St. Clair County Circuit Court Records
SL&TC v. WSR - Shelbyville Loan and Trust Company vs. White Star Refinery
SIMAPC - Southwestern Illinois Metropolitan Area Planning Commission, Collinsville, Illlinois
USEPA - United States Environmental Protection Agency
USDA - United States Department of Agriculture
USDI - United States Department of the Interior
USGS - United State Geological Society
USHEW - United States Department of Health, Education, and Welfare
WRD&LD - Wood River Drainage and Levee District

Acknowledgments

This report bears the imprint of many individuals who deserve recognition for their contributions. The Circuit Court clerks and their staffs in Madison and St. Clair counties were tolerant of my searches for old documents and provided invaluable aid in tracking down certain court records. Archivists, librarians, and clerks at the levee districts, the local libraries, the Southern Illinois University-Edwardsville archives, the State Archives, the State Historical Library, the Southwestern Illinois Metropolitan Area Planning Commission, the Illinois Evironmental Protection Agency, the State Water Survey, and the State Library assisted in innumerable ways. Through their efforts and generous assistance, the material contained in this report became available.

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Abstract

Madison and St. Clair counties contain large areas of land underlaid by sand and gravel aquifers, which are highly susceptible to contamination from land-buried hazardous materials. In addition, heavy industries were very active in the two-county area during the first third of this century. This combination of circumstances warranted an historical investigation to determine the possible extent of past hazardous waste-related activity that may continue to affect current residents of the area.

A thorough review of archival records provided sufficient information to reconstruct the past industrial geography of the two-county area, the history of waste management and public water supplies, and the sequence of surface alteration. Jointly, this collection of information permitted the mapping of zones of possible human exposure during much of the last 100 years.

Cartographic analysis of the map series suggests that there was little residential or commercial intrusion on former disposal grounds, but that contamination of public water supplies may have occurred in the past and may occur in the future.

Executive Summary

Madison and St. Clair counties emerged as major manufacturing centers during the 1890s and they experienced considerable industrial growth throughout the first third of the twentieth century. In recent decades, however, the manufacturing component of the economy has declined. The reduction in industrial activity has occurred during a period of increasing scrutiny of hazardous waste disposal activity, and major sources of hazardous materials may have closed before regulatory agencies began to keep systematic records on waste generation and disposal. Given a geologic and hydrologic situation that would allow land-disposed wastes to easily contaminate shallow sand and gravel aquifers, this two-county area was considered an ideal setting for an historical review of industrial waste management.

To gain insight into the hazardous waste history of the Madison and St. Clair industrial region, a reconstruction of two critical components of the region's past from 1890 to 1980 was attempted. The first of these was the industrial history. By tracing the development of manufacturing activity from its inception through its peak (ca. 1929), this study identified numerous sources of hazardous materials omitted from electronic files of hazardous waste generators. Furthermore, it provided a means to analyze the historical sources of wastes by comparing the geography of relict waste disposal sites with recent residential and public works developments.

Before 1930 the availability of inexpensive Illinois coal and ample water supplies attracted a complex of hazardous material sources to the American Bottoms, an alluvial floodplain stretching from Alton to beyond Sauget. Primary metal producers, coke and chemical plants, oil refineries, and metal finishing and fabricating firms dominated the inventory of hazardous material handling companies. They clustered in three zones on the flood plain of the Mississippi: Alton-Wood River, Granite City, and East St. Louis, and in the three upland communities.

The second component of the reconstruction was a review of waste management practices. During the first three decades of this century, there was virtually no treatment of industrial or municipal sewage. Untreated liquid wastes poured into streams, canals, and lakes throughout the two-county region, and solids accumulated in low areas. Numerous hazardous substances were included in the wastes released during this early period, but municipalities and state agencies targeted putrescible wastes as the primary public health concern. During and after the 1930s, state government and industry began to take greater notice of the effects of potentially harmful materials emitted by factories. They have jointly taken action to reduce the volume of liquid wastes, although this has resulted in the concentration of hazardous materials in sludges that have been buried in landfills.

By contrasting the record of waste generation and waste management with the land use and water consumption histories of the two-county area, this report offers an improved understanding of possible human exposure. Direct human exposure to past hazardous waste disposal is limited to several areas of encroachment of residential land uses on former dumps. Indirect exposure, in the form of consumption of contaminated water, was probably much more widespread in the past. Public water supplies fed polluted Mississippi River water into many homes in the region, although this hazard has diminished in recent years. Although the summary maps show that existing public water supply wells are not immediately threatened by documented hazard materials disposal sites, there has been extensive ground-water contamination in the Sauget area suggesting the documentary evidence is incomplete.

Based on the review of waste generation and management practices of the past, we make the following recommendations:

1. Full-scale ground-water monitoring should be implemented in Madison and St. Clair counties with all due haste, and monitoring wells should be situated to detect both recent and historical hazards.

2. Cooperative programs between the Hazardous Waste Research and Information Center and manufacturers should be initiated to document more thoroughly historical waste management practices and to reduce waste generation.

3. Landfills above the major ground-water pumpage areas should be monitored for possible saturation as ground-water levels rise and subsequent release of hazardous materials.

4. Methods for enhancing the historical utility of HWRIC-sponsored data bases should be considered.

CHAPTER 1 - INTRODUCTION

Madison and St. Clair Counties contain a once thriving manufacturing zone which stretches across the American Bottoms, an alluvial floodplain stretching from near Alton to beyond Sauget (Fig. 1.1). Although industry is still highly evident in the region, its dominant position in the economy has declined. Both economic and geographic situations were different in 1890 when several factors combined to promote development of the industrial complex there, and many of the same features of the area which attracted manufacturers contributed to the accumulation of hazardous materials in the environment. Inexpensive Illinois coal lured Missouri producers to the east side of the Mississippi River for economic reasons and also worked to attract industries historically associated with hazardous materials. Copious water supplies and an advantageous geographic situation provided an impetus for the construction of oil refineries, also sources of hazardous materials. Following the construction of extensive levee systems beginning in 1909, the undeveloped portions of the Mississippi River floodplain, with its open space for factory construction and waste disposal, became marketable property. In recent years, changes in the national economy have reduced industrial production throughout the region, yet the natural features of the area and its industrial past combined to create a situation deserving historical analysis of hazardous waste activity.

There are several programs designed to provide information about past and present hazardous waste disposal activity. Yet the earliest of these programs, the Resource Conservation and Recovery Act of 1976, is relatively recent and only touches the surface of historical industrial activity. The initial National Priorities List found nearly one quarter of the Superfund sites (those deserving immediate cleanup) active from before 1950, but the proportion of older sites has fallen in successive updates (Greenberg, 1984 and Colten, 1988). This is due largely to the methods used to compile the disposal site inventories. Both state and federal programs rely largely on self-reporting techniques, which cannot adequately include defunct businesses or even pre-1940 waste disposal activity conducted by extant companies. New York State was able to elicit only a 59 percent response rate when it surveyed industries on their waste-related activity over the past thirty years (NYDEC, 1985). The remaining 41 percent could have been responsible for significant accumulations of hazardous materials, to say nothing of the businesses which no longer exist and were not able to be queried. While some argue that most waste sites have been identified (Anderson, 1987), the uncontrolled and undocumented nature of pre-1950 waste disposal undermines this position.

This report will attempt to identify unknown sites and document past industrial waste disposal activity in the East St. Louis region (the two-county study area) by tracing industrial development forward through time, rather than moving from the present back into the past. By starting with the industrial complex of 1890, it will focus on the industries which were active during the peak manufacturing period and will not be hindered by recent factory closures. The report will add a review of public services such as sewage treatment and water supply as a means of delimiting corridors of possible waste movement and zones of possible public exposure. A reconstruction of landform modification in the vicinity of waste generators will also provide background on disposal activities during the past century. Such methodology should prove complementary to the existing databases (Schock, 1986 and Dixon and Hansel, 1985) and the ongoing environmental analysis in the area (St. John, 1981; Ecology and Environment, 1986; and Shafer, 1985).

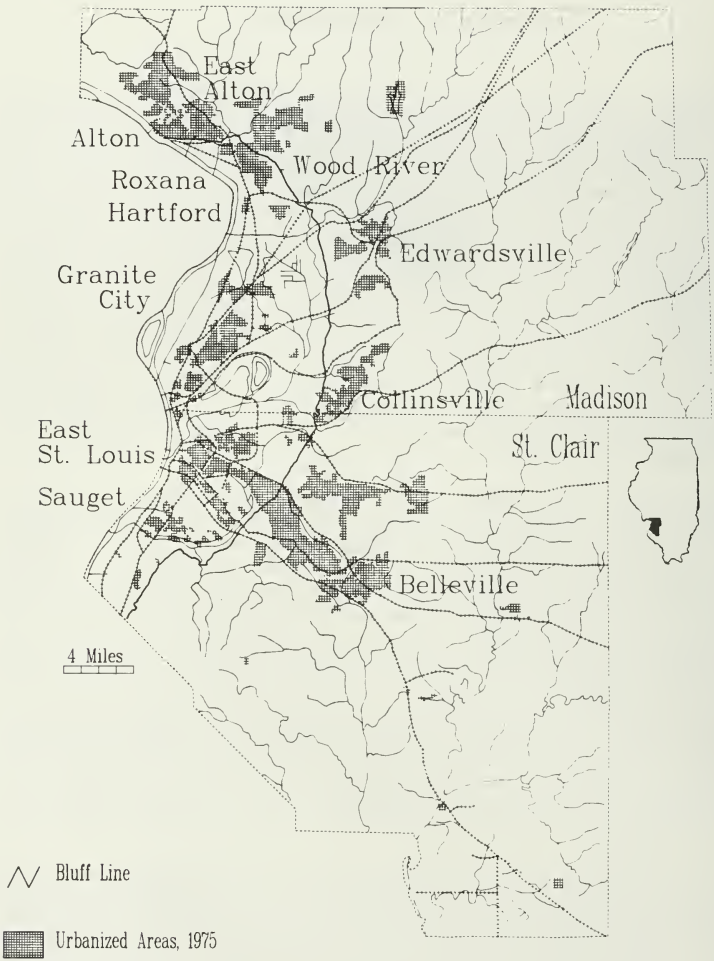


Figure 1.1. Madison and St. Clair Counties.

1.1 Historical Frameworks for Industrial Waste Disposal

The general perception that hazardous industrial wastes are a recent phenomenon is perpetuated by most writers on the subject (The term "hazardous wastes" will be applied to such industrial wastes despite the relatively recent [1976] development of legal terminology which is more restrictive in its definition.). A typical example states that "[b]eginning with the end of World War II, a veritable technological revolution has taken place in the production of particularly hazardous materials, products, and processes" (Kates, 1977: 4). While the volume of synthetic organic chemicals has risen ten-fold since 1945 with a corresponding exponential growth in hazardous substances (Sarokin, et al., 1985: 16-19), hazardous wastes are not unique by-products of the post-war period. Numerous examples of late nineteenth-century manufacturing processes indicate that hazards have been left by the predecessors of today's chemical plants. Organic chemicals were produced widely during the 1920s as were petrochemical products and a host of other products associated with durable environmental contaminants (Colten, 1988; Tarr, 1985a, Coates, 1982). As the scale of industry grew, so too grew the volume of wastes generated by American manufacturers, and before 1930 there were virtually no controls on waste disposal (Tarr, 1985b).

Turn-of-the-century manufacturers and public works engineers had little concern with industrial effluent. They considered dilution an adequate form of treatment for most liquid wastes, and the Mississippi River could easily serve the growing set of factories in the St. Louis region (Tarr, 1985b). Developers and builders saw solid wastes as valuable materials for reclaiming low ground and tons of slag and other bulky wastes filled the sloughs and ponds of the American Bottoms. The growing chemical industry found marketable uses for some wastes during the 1920s, and a rising concern with water pollution prompted experimentation with waste treatment and by-product recovery during the 1930s. Nevertheless, treatment remained minimal and most industrial wastes were "improperly disposed of in open pits, surface impoundments, vacant land, farmlands, and water bodies." (Anderson, 1987: 182) Pollution-control regulations of the 1960s initiated widespread utilization of waste treatment facilities by both manufacturers and municipalities. The residue concentrated by treatment facilities, whether sludges produced from sewage or sediments collected by precipitators, required disposal, and as federal legislation targeted air and water pollution, it inadvertently shifted the environmental burden of disposal to land sinks (Tarr, 1984).

The geography of industrial activity added to the casual manner of waste disposal during the early years of this century. Seeking to escape municipal taxes, high land prices, and nuisance statutes, manufacturers located many plants in suburban sites between 1870 and 1920--this is precisely the case in the East St. Louis region. Clusters of industries serving as sources of products or consumers of by-products developed on relatively poor quality land (Colten, 1986). Beyond the city limits, municipal services such as sewage and water delivery seldom reached the suburban industrial complexes at the time of their development (Rosen, 1986). Consequently, they constructed their own water systems and developed internal methods for handling wastes. When urban services finally reached far-flung industrial districts, they were not needed or desired. Thus, there were often lags between the availability of sewage treatment and actual use of such services. This could, and did, cause continuing industrial waste accumulations in manufacturing districts after services became available.

This brief overview suggests the East St. Louis region had all the essential geographic characteristics for large quantities of industrial wastes to accumulate. The complex of industries

generated hazardous wastes, the environmental conditions were precisely the type commonly usedfor waste disposal, and the political and geographic situation was conducive to uninhibited release of hazards. A retrospective analysis of these factors which were closely linked to hazardous material accumulation will provide essential detail of the history of industrial waste management in the East St. Louis region.

1.2 Reconstructing Past Waste Management Practices

The principal guide to selecting the Madison-St. Clair region was a recent report which delimited large areas of the American Bottoms as deserving high priority for ground-water monitoring (Shafer, 1985; see Fig. 1.2). The study analyzed both hydrologic and current hazardous material related activity to guide the design of ground-water monitoring systems. The high priority status of much of the American Bottoms suggested historical analysis could enhance the selection of ground-water monitoring sites.

Neither industrial activity nor waste disposal are spread evenly over the earth's surface. A quick scan of maps of manufacturing (see Fig. 1.3) and landfills (see Fig. 1.4) in the East St. Louis region makes this point evident. Factories are concentrated in several clusters along the Mississippi River and in the Belleville-Collinsville corridor on the uplands. Not surprisingly, landfill activity mirrors the distribution of population and manufacturing. Given the uneven pattern of activities associated with hazardous materials, a screening procedure was employed to concentrate on the area with the highest probability of such activities.

The first stage of the screening process was to identify areas of hazardous waste activity near the peak of industrial activity in the two-county region. Manufacturing employment grew dramatically between 1890 and 1929 (see Table 2.1, p. 14). For the two-county region, the number of wage employees increased from 5,904 to 39,450. While the number of workers continued to climb until about 1970, the number of establishments peaked in 1929, and most growth after 1930 was a product of internal expansion. Thus, geographically, 1929 is an appropriate date for delimiting the fullest extent of manufacturing activity.

A second step was to select the industries where hazardous materials might have accumulated. A review of occupational health literature provided general industrial categories where workers faced exposure to harmful substances during the early twentieth century (Table 1.1). Industries within the study area which fell into these categories were selected from the Illinois Manufacturers Association Directory (1929) and from fire insurance maps. Thus a map of approximate late-1920s industrial land use where hazardous materials were handled became the first product of the screening process. To account for off-site waste disposal and possible future expansion, a one-mile radius buffer was added around each industrial cluster. Together, the areas of known hazardous materials activity and the surrounding buffers delimit areas of probable accumulations of hazardous industrial wastes (Fig. 1.3).

The extensive wetlands of the American Bottoms presented challenges for early factory developers, but challenges with well-known contemporary solutions. Levee building, stream diversions, quarrying, strip mining, and land reclamation reshaped the topography of the floodplain. In doing so, engineers altered the natural drainage and created areas where water-borne sediments accumulated, as well as repositories for all manner of urban and industrial wastes. To identify areas of likely accumulation of wastes, whether deposited by natural processes or human agency, a surface alteration map was created (Fig. 1.4). It is a composite of natural

Figure 1.2. Combined Area of Intensive and High Moniioring Priority. Source: "Target Areas for Hazardous Substance Ground-water Monitoring in Sand and Gravel Aquifers," prepared by Wehrmann and Le Seur, in Shafer, 1985.

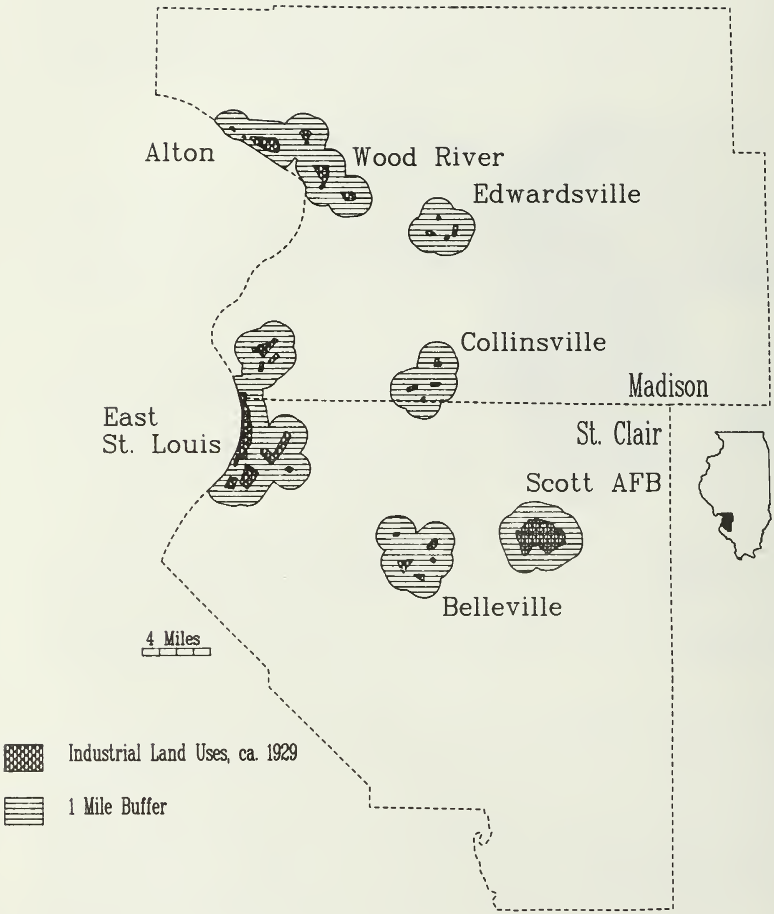
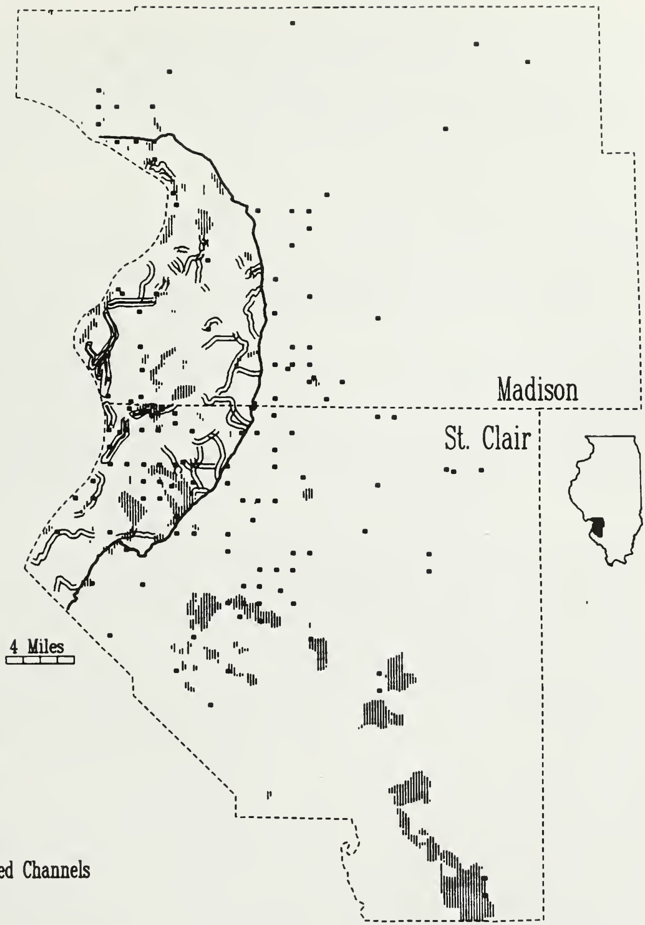


Figure 1.3. Industrial Land Use, ca. 1929 and One-Mile Buffer. Source: IMA, 1929.



Landfills

Abandoned Channels

Surface Alterations

Figure 1.4. Surface Alteration History. Landfills appear to have a regular pattern due to incomplete legal location descriptions contained in the electronic database. Symbols are automatically placed in the center of the section in such situations. Sources: USDA, 1978, 1986; Illinois Abandoned Mined Land Reclamation Council, 1980; ISGS Landfill Inventory; USGS Topographic Maps; ESL&SD Records; and Wood River Drainage and Levee District Records.

Table 1.1. **Hazardous Materials-Handling Industries, 1929.**

Standard Industrial Classification	Industry
2491	Wood creosoting
2700	Printing
2800	Dry cleaning, ammunition, dyes, chemicals
2900	Petroleum and coal products
3100	Shoe manufacturing (tanning)
3200	Glass manufacture and clay products (excavations)
3400	Metal fabrication
3500	Machinery
3600	Electrical machinery

Sources: Coates, et al., 1982; Hamilton, 1925; McCord, 1931; and Oliver, 1902.

drainage systems, man-made drainage alterations, landfilling activity, and surface excavations. The final product depicts areas of historical sedimentation down-gradient from industrial areas, stream channels abandoned by flood-control projects, and major quarries and coal mines. Together, these three environmental categories represent areas typically used for industrial waste disposal, thus delimiting zones of possible accumulation of industrial wastes (Conzen, 1987: 367; Colten, 1985).

The combined areas of the two maps (Figs. 1.3 and 1.4) depict a zone of industrial activity associated with hazardous material and the type of surface modifications generally linked to industrial waste accumulation (Fig. 1.5). While not definitive of the distribution of hazardous waste sites, the summary map defined the area deserving more intensive scrutiny and it largely fell within the area designated as high-priority by Shafer (1985:cf. Fig. 1.2 and 1.5).

Following the screening of high-probability zones of hazardous materials, a more detailed study of three interrelated historical processes was carried out. The first process identified the generators of hazardous substances. All industries operating within the screened area were surveyed for possible hazardous materials used in their production cycle. This included a review of active and inactive manufacturers, analysis of processes used within the various plants, and a consideration of general waste streams associated with each particular class of industry. Trade literature, industrial directories, interviews, and archival records provided a partial inventory of sources of hazardous wastes.

A second factor in the history of hazardous materials accumulation is the manner of waste management. Although the specific record of waste disposal is fragmented and incomplete, it is possible to reconstruct a partial history. Through archival records and trade journals, the general nature of industrial waste disposal can be documented. Municipal and state records provide details on the construction and extension of public waste treatment systems, and court records provide some specific information on the release of hazardous substances. A reconstruction of past waste management practices, although incomplete, reveals a rough outline of what wastes were deposited in certain localities at known dates. From this sketch, an analysis of possible human exposure becomes feasible.

The third component of the in-depth survey is the set of processes which could cause public exposure to hazards. This section focuses on the development of public water supply systems and possible exposure through contaminated water. Also included are discussions of land use change which might have allowed residential encroachment on former industrial property and surface modification in public areas. This portion of the report is speculative and not to be considered a formal risk assessment. It consists of a series of overlay maps contrasting past hazardous material-related activity with the distributions of current populations and public services.

1.3 Objectives

The objectives of this project can be evaluated at several different levels. At the local level, a review of this type can identify unknown hazardous waste sites, or at least provide better documentation for known sites. By providing local public health officials with more complete historical information they will be better prepared to undertake risk assessments and proceed with clean-up activities. This review can provide useful information to other state agencies as well. It assesses the usefulness of various databases in historical analyses of past hazards, it provides a

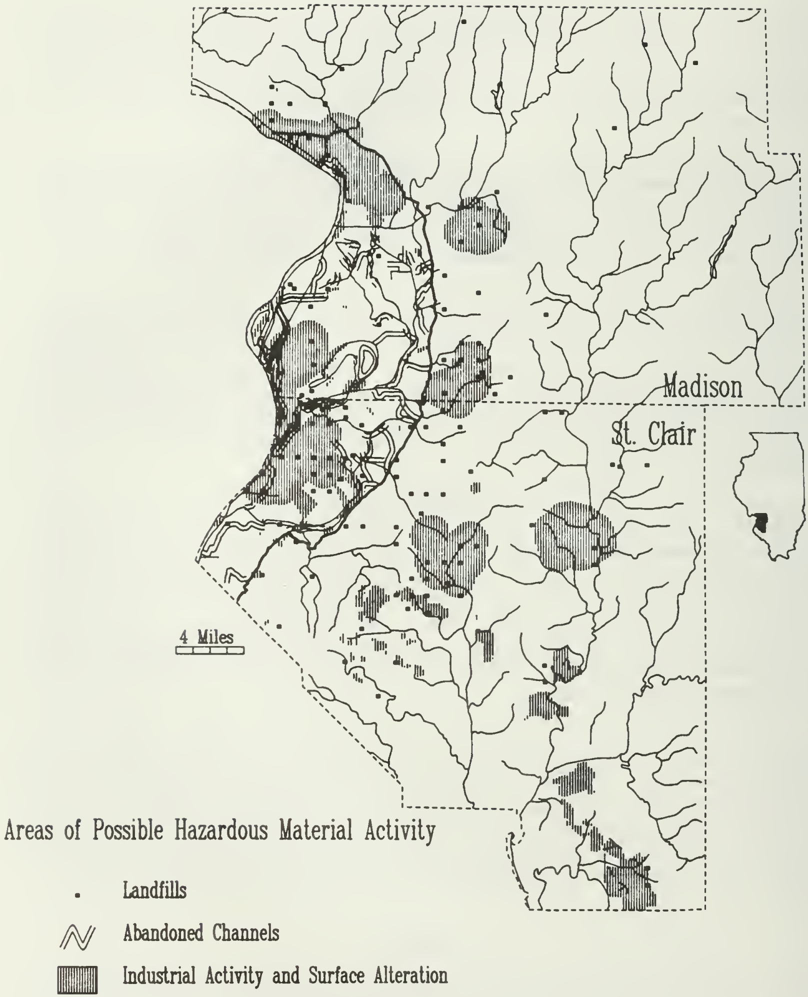


Figure 1.5. Area of Combined Hazardous Material Activity and Possible Accumulation of Hazardous Materials.

geographic framework for ground-water monitoring, and it expands on our overall understanding of past waste disposal activities in Illinois. Finally, it provides additional empirical evidence to use in a chronology of past industrial waste management, the analysis of waste disposal in urban development during the past century, and an assessment of the overall significance of pre-1950 industrial wastes. At all levels, this project has practical utility and yields useful information.

CHAPTER 2 - INDUSTRIAL WASTE SOURCES, 1890-1980

The existence of hazardous wastes in the environment is contingent on two basic human activities. The first, and perhaps most important, is the operation of manufacturing activities which create wastes. A second related activity is the transfer of wastes from factory sites to disposal grounds. There are of course other means of depositing hazardous substances in the environment such as the release of agricultural chemicals and even dumping of hazardous household products. Nevertheless, for the purposes of this study it is wholly appropriate to focus on industrial activity as the major source of persistent hazardous substances. During the first half of this century, industry produced and disposed a large proportion of all hazardous materials in Madison and St. Clair counties. Furthermore, prior to the passage of legislation which regulated waste disposal, manufacturers were free to discard wastes in a casual manner, and to avoid incurring high costs they seldom transported the wastes great distances. Hence, the areas where industries worked with hazardous substances became the primary repositories of hazardous materials.

This section will look at the chronology of industrial development in Madison and St. Clair counties as a means of assessing the generation of hazardous wastes. It will also consider the evolving geographical pattern of manufacturing activity to identify areas of past hazardous substance-related activity. Industries which handled all manner of hazardous materials will be considered possible sources of hazardous releases. Incomplete documentation of past disposal practices and known associations between accumulations of hazardous materials and factories which handled those substances require that such a broad definition of hazardous waste generators be used (Colten, 1988).

2.1 Early Industrial Development, 1890-1929

Before 1890 there had been limited industrial activity on the east side of the Mississippi River across from St. Louis. Railroads focused on the population and manufacturing center of the region. Nevertheless, the absence of bridges--forcing trains to break for the ferry trip across the river--fostered some manufacturing activity in selected east-bank districts. Alton, an early rival to St. Louis' regional dominance, built an industrial base on its limestone quarry, and the Illinois Glass Company started operations in 1873. East St. Louis became the railhead for east-bound freight and attracted meat-packing plants which opened in 1874. In addition, flour mills serving the Illinois agricultural hinterland became established along the waterfront in East St. Louis. A third concentration of industries developed in the Belleville area and consisted of metal-working concerns and breweries. These three incipient cores of manufacturing, along with extensive coal mining, provided a foundation for future development and strongly influenced the composition of subsequent industrial complexes (Harper, 1965: 72-77).

Between 1890 and 1919 the scale of manufacturing on the east side grew dramatically, and the number of factory wage earners in Madison and St. Clair counties increased 122 percent. Although the rate of increase slowed somewhat during the next decade, the overall gains in terms of total employment were significant. The number of wage earners rose from 1,686 in 1890 to 22,089 in 1929, and St. Clair's count of factory jobs rose from 4,218 to 17,361 during the same

period (Table 2.1). Manufacturing employment rose from 3.3 and 6.3 percent of the total population in Madison and St. Clair counties in 1890 to 15.4 and 11 percent respectively by 1929.

The expansion of industrial activity in the East St. Louis region reflected national growth in the manufacturing sector both in the types of factories involved and their scale of operation. Mergers, consolidations, and vertical integration vastly increased the scale of industrial operations and centralized control (Chandler, 1977). In Madison and St. Clair counties, this is indicated by the inverse relationship between the number of jobs and the number of manufacturing establishments. The total number of manufacturing establishments fell from 234 in 1890 to 198 in 1929 in Madison County and from 353 to 282 in St. Clair (Table 2.1). Thus, the average number of employees per operation rose from seven to 112 in Madison and from twelve to sixty-two in St. Clair. The marked difference between the two counties indicates a persistence of small-scale, craftsman-type manufacturing in St. Clair--particularly in the Belleville area--while several large-scale factories opened after 1890 in Madison County. In fact, over half of the large-scale plants operating in 1965 had their origin between 1890 and 1920 (Harper, 1965: 82).

Numerous local factors combined to encourage selection of east-side sites for industrial construction. A limited number of conveniently located tracts of land in St. Louis prompted entrepreneurs to look for property on the Illinois side of the river (Taylor, 1915: 129-30). With the completion of bridges across the river, starting with the Eads in 1875, St. Clair and Madison counties' waterfront and railside properties took on new attractiveness with its level topography and the availability of large contiguous parcels of land (Thomas, 1927: 84-5). The one obvious disadvantage, periodic inundation, was addressed after the 1903 flood, when regional drainage districts organized to construct levees and diversion channels. Legal differences also contributed to the selection of east-side sites. The absence of smoke abatement legislation in Illinois and also the tolerance of longer work days and weeks in Illinois were additional attractions (Taylor, 1915: 130-2). A natural advantage of the Bottoms was the nearly unlimited supply of water. Both surface water and rich supplies found in shallow sand and gravel aquifers were easily accessible for industries requiring large quantities of process water.

Perhaps the most notable lure of the east side was the existence of cheap fuel for use in factories. Soft Illinois coal existed in abundant supplies near the surface in St. Clair County and in shallow strata beneath Madison County. Extraction of these deposits began in the mid-nineteenth century, although significant economic advantages for east side consumption of that coal arose later. In 1915 the Terminal Railroad Association charged only thirty-two cents to deliver a ton of coal to any east-side location while charging fifty-two cents per ton for delivery in St. Louis (Taylor, 1915: 130). Opposition to this policy resulted in a hearing before the Interstate Commerce Commission, which ruled that the differential rate was justified (Thomas, 1927: 84-5). Thus, industries which consumed large quantities of coal such as steel mills, smelters, and power plants found economic advantages in selecting sites on the east side.

The coal advantage strongly influenced the basic set of industries on the east side, which in turn affected the makeup of associated industries. Generally, industrial districts expand as producers of affiliated products cluster near a source of semi-processed materials or as primary processors relocate to reduce transportation costs of their product to a secondary processor (Pred, 1964). In the East St. Louis area, steel mills attracted metal-fabrication plants, metal-plating firms, and, as the scale of steel-making operations increased, blast furnaces to supply pig iron. Coke works came in conjunction with primary-metal operations as did by-product industries, such

Table 2.1. **Manufacturing Establishments and Employment in Madison and St. Clair Counties.**

Year	Madison: Number of Establishments	Madison: Employees	St. Clair: Number of Establishments	St. Clair: Employees
1890	234	1,686	353	4,218
1929	198	22,089	282	17,361
1949	182	34,637	252	23,158
1953	202	38,506	261	26,098
1959	207	33,803	242	19,719
1964	184	35,237	245	15,555
1969	199	35,415	227	17,257
1974	194	31,373	180	11,437
1979	188	30,097	174	10,478

Sources: U.S. Census, Census of Manufacturers, 1890 and 1930; U.S. Department of Commerce, County Business Patterns, 1949, 1953, 1959, 1964, 1969, 1974, 1979.

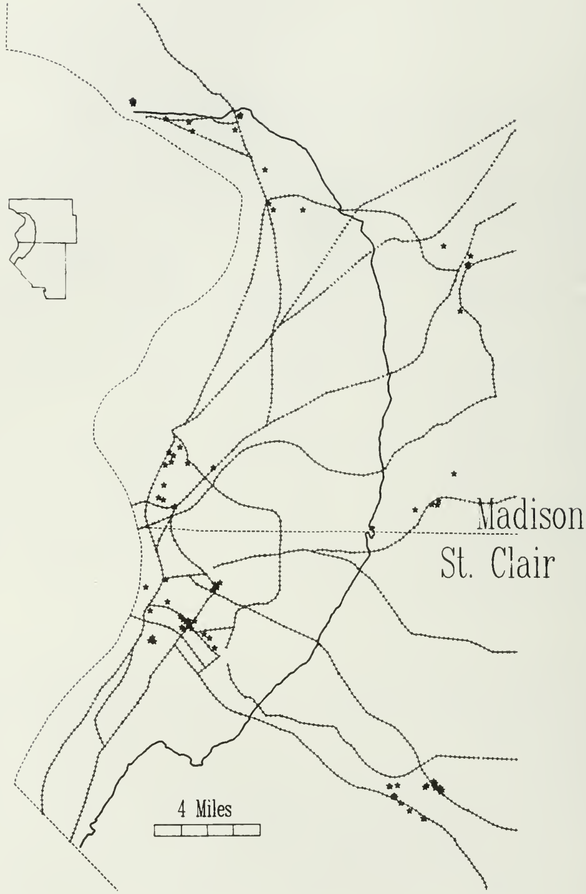
as creosoting operations, roofing materials, explosives and chemical plants. Another source of by-products was the packing industry which supplied a source of materials for fertilizer producers and hides for tanning and shoemaking. Acid works were another type of operation with linkages to the steel and metal-working plants, and they established a foundation for other chemical manufacture. Oil refiners chose the American Bottoms largely because of copious water supplies, available property, and proximity to major Midwestern markets--the coal advantage and linkages to coal-dependent industries were negligible in their decisions (Harper, 1965).

Based on a review of pre-1940 Superfund sites and the occupational health literature for the pre-1930 period, the presence of hazardous materials was widespread among the type of industries that developed in Madison and St. Clair counties (USEPA, 1984; Coates, 1982; McCord, 1931; Hamilton, 1925; and Oliver, 1902). Lead and zinc smelters were acknowledged as sources of toxic metals which posed health threats to workers and also damaged surrounding vegetation (Illinois Commission on Occupational Diseases, 1911). Accumulations of metals are also associated with foundries, and there were several in the two-county region. Steel mills typically generated a variety of wastes including acids, phenols, cyanides, and oily liquids. Coal and coal by-products operations also handled a variety of hazardous substances, although some materials were destined for use in a final factory product. Nevertheless, the presence of hazardous materials on site commonly led to accumulations. Local gas works, found in several of the communities, chronically left tars on site and also generated phenolic wastes. Coke works produced similar wastes in larger quantities, although the development of roofing products and munitions plants created a market for tars and toluene. The accumulations of organics at such operations is a possibility, and pentachlorophenols (PCPs) have been found at many creosote operations throughout the country. Chromium wastes were hazards at leather tanning operations after the 1920s, and arsenic and cadmium were hazards associated with glass works. Finally, the petroleum refineries of the early twentieth century issued oils, acids, metals, and phenolic wastes. Thus, the complex of industries found in the Madison-St. Clair study area included many of the major sources of pre-1930 hazardous materials and wastes.

A total of 116 industries in the two-county region typically handled hazardous materials in 1928 (Fig. 2.1) (Illinois Manufacturers Association, 1929). This tally included all industries in the categories listed in Table 1.1. This rather high total points out a possible historical deficiency in the HWRIC database of potentially contaminated sites (Schock, et al., 1986). A review of the sites included in the HWRIC inventory indicates that a total of only twenty-seven sites were active before 1930, yet few of these were major hazardous-material producers at that time. Whether the discrepancy results from businesses changing their names, from the inherent difficulty of determining the starting date of manufacturing operations, or from a broader definition of hazardous substance-handling industries is difficult to determine. Nevertheless, it suggests that the older sites may be under-represented in the database. The total found in the IMA directory indicates the handling of hazardous materials was widespread before 1930.

2.2 Recent Industrial Activity, 1930-1980

The economic uncertainties of the Depression years interrupted the rapid growth of industry in the two-county region and forced some of the smaller firms to close. By the end of the 1930s, manufacturing in Madison and St. Clair counties was characterized by a few large manufacturing operations (Harper, 1965: 89). Entry into the Second World War encouraged company owners to expand and modernize their plants. Critical industries such as petroleum refining, munitions, and



* Hazardous Material Handling Industries, ca. 1929

Figure 2.1. Hazardous Material Handling Industries, ca. 1929. Addresses of some of the industries listed in the IMA Directory were not available and these have been omitted. Source: IMA, 1929.

steel making expanded during the war and increased their number of employees. Shortly after the end of World War II, manufacturers employed nearly 20,000 more workers than in 1929. Both Madison and St. Clair counties experienced employment peaks about 1953 when 64,604 workers were engaged in manufacturing jobs (Table 2.1). There was a decline in both the number of workers and industrial establishments during the late 1950s and early 1960s. This resulted in the elimination of many companies, some of which handled hazardous materials (Harper, 1965: 90).

Since each derelict industry is a potential site of waste accumulation, an attempt was made to estimate the number of industrial closures involving hazardous materials handling operations. A review of the HWRIC database (Table 2.2) indicated that there were 111 businesses which closed during the 1950s and 1960s (8.2 percent of the total listings). Statistics compiled by the **County Business Patterns** supports the HWRIC data. For all industries (not just those handling hazardous materials), the number of establishments in Madison County declined 1.5 percent between 1953 (the post-war peak) and 1969 (Table 2.1). St. Clair County registered a decline of 13 percent for the same period. When only those Standard Industrial Codes associated with hazardous materials were tallied, they showed the number of St. Clair industries declined 22 percent while Madison's total fell only 1.1 percent. While not well-matched sources of comparative information, the relatively similar number of closures for St. Clair supports the utility of the HWRIC database--although the Madison County results provide a warning that this data set needs to be cross-checked when used as a historical reference.

Although the trends of the early 1960s were reversed briefly in the early 1970s, there has been a steady decline in the number of industrial jobs in the two-county region since 1974. Madison County held on to 30,000 positions in 1979 while St. Clair had dropped to 10,000 (Table 2.1). One factor viewed as a deterrent to renewed development was the passage of pollution control legislation during the late 1960s and early 1970s (Thornton and Koepke, 1981: 326). A review of the HWRIC database indicates that sixty-three hazardous material handling industries in St. Clair County (10.4 percent of the total companies operating in that decade) ceased to operate while only thirty-eight, or 5.9 percent, ceased operations in Madison (Table 2.2). The net effect of the manufacturing decline has been to idle several factories and reduce the number of hazardous material sources.

2.3 Industrial Waste Generation

Previous reports attempted to calculate gross estimates of the volumes of industrial waste production based on employment (Colten, 1988; Colten and Breen, 1986; and Colten, 1985). Multipliers developed for the State of Illinois were applied to tallies of the number of employees in major industrial categories (Weston, 1974). This strategy provided unsuccessful results for the current investigation due to the inconsistent quality of the historical record. Illinois Manufacturers Association directories included sporadic counts of the number of employees in specific plants. The two other major sources of such information, the **U.S. Census of Manufacturers** and the **County Business Patterns**, fail to provide systematic information. The census summary reports do not offer consistent geographic or job category listings, while the County Business Patterns provide ranges of employment rather than precise counts. This is particularly true for the major sources of hazardous wastes. Hence, no satisfactory estimates can be offered.

Table 2.2. **Industrial Closures, 1930-1970.**

Decade	Madison		St. Clair		Two County Total	
	Number	% of Decennial Total	Number	% of Decennial Total	Number	% of Decennial Total
1950s	13	7.5	6	2.7	19	4.8
1960s	39	10.4	53	12.2	92	11.3
1970s	38	5.9	63	10.4	101	7.5

Source: Illinois State Water Survey. Hazardous Waste Research and Information Center Database, 1987.

There were obvious concentrations of industries associated with hazardous materials before 1930 and these remained important nodes of hazardous waste generation throughout the next fifty years. More than 96 percent (112 of 116) of all industries linked to hazardous materials in 1928 were located in Alton, Wood River, Granite City, East St. Louis (including adjacent manufacturing towns), or Belleville.

2.4 Industrial Districts

The clustering of hazardous material handling industries provides a framework for closer scrutiny of the several areas of concentrated activity. This section will review the historical development of four manufacturing districts. The first three are distinct clusters found on the American Bottoms--Alton-Wood River, the Tri-cities area, and the East St. Louis manufacturing complex. The fourth area is more dispersed and includes the upland industrial communities of Belleville, Collinsville, and Edwardsville.

2.4.1 Alton-Wood River

The Alton-Wood River industrial complex developed on a triangular parcel of floodplain immediately downriver from Alton (Fig. 2.2). One exception to this locational generalization was the Alton Gas Works which began operation in 1855 on Belle Street. By 1877 it was distributing gas throughout Alton, although it shifted to electrical generation in 1885 (Federal Writers Project, 1936). Nevertheless, it continued the manufacture of local gas through 1915. Its facilities have long since been removed from the landscape, and the Alton Post Office now occupies its former site.

In 1873 the forerunner to Owens-Illinois Glass Company began operations. After two years of growth, the company, with the help of the city, acquired a parcel of reclaimed land where Shields Creek emptied into the Mississippi River and established its new base of operations. By 1887 there were five furnaces in operation and as many as 900 workers turning out glass bottles. The company added automated bottle-making machinery in 1911 and gradually phased out the hand-blown operations. In 1929 Illinois Glass merged with Owens Bottle Company to become Owens-Illinois (Owens-Illinois, n.d.). The company employed about 4,000 workers by that time (FWP, 1936). Although modernization of the operations allowed the total number of employees to fall to around 2,000 by 1969, the glass works remained a major employer in the Alton area. Historically, arsenic and cadmium have been associated with glass productions and both the Godfrey and Alton plants generated RCRA-regulated wastes in recent years (IEPA, 1985). Currently, the Alton plant is closed and undergoing demolition.

Other early twentieth-century industries characterize the range of hazardous waste generators. Laclede Steel began operation as a rail re-rolling operation in 1911 and expanded alongside the glass works. By the 1960s it employed 4,000 workers and specialized in reinforcement bars and tubing. In 1984 it produced over 775 tons of RCRA wastes (IEPA, 1985). Another industry which began in the the 1910s was the American Pigment and Chemical Company. Although it failed during the Great Depression, it struggled through several corporate incarnations for more than two decades, during which time it produced a variety of barium paint pigments and a barium carbonate rat poison (**Alton Evening Telegraph**, 1910-32). The company operated east of Alton

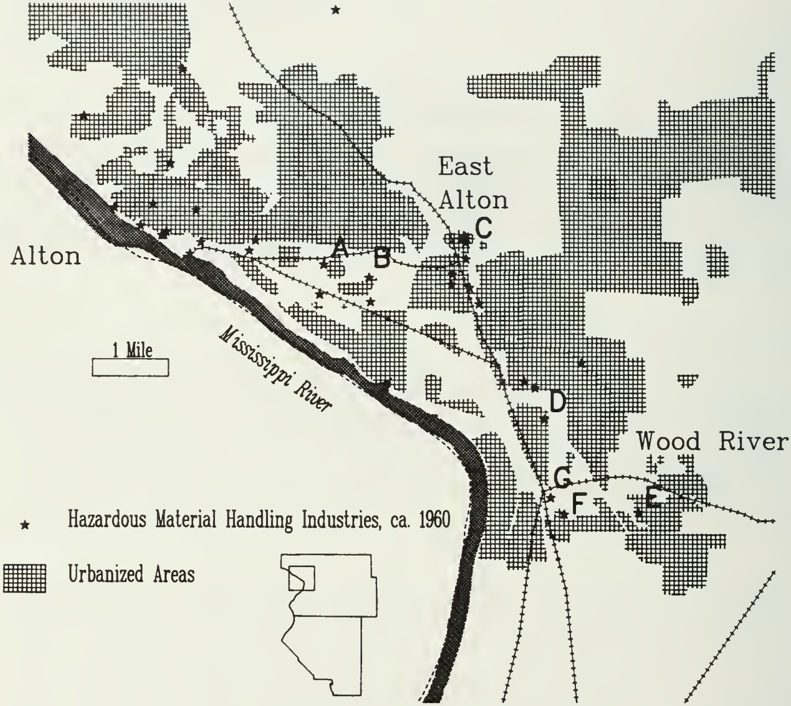


Figure 2.2. Hazardous Material Handling Industries in the Alton-Wood River District, ca. 1960. A. Owens-Illinois Glass Co., B. Laclede Steel Co., C. Olin Mathieson Chemical Corp., D. Standard Oil, E. Shell Oil Company, F. The Clark Oil Co., G. International Shoe Co. Source: IMA, 1960.

on the floodplain. A final contemporary of the steel and pigment companies was the Alton Box Board Company. Starting operation in 1911, the box board company manufactured cardboard containers and putrescible, sulfite-laden wastes (Alton City Plan Commission, 1928, and Howe and Van Antwerpen, 1939). Although seen as the chief source of water pollution in the Alton area during the first half of this century, it has not been a major source of hazardous wastes.

The East Alton munitions industry provided a second nucleus of hazardous material-related activity. Begun as a powder mill in 1892, the Olin-Mathieson Chemical Corporation (formerly Equitable and Western Cartridge) grew as coal mines demanded powder to open shafts and it expanded further during World War I. Federal Lead built a lead smelting plant to serve the munitions plant in 1901 and Olin added a brass works in 1916 (FWP, 1936, and Madison County Sesquicentennial, 1962). Both metals and organic chemicals are hazards associated with such operations, and in 1984 Olin produced over 200 tons of RCRA wastes (IEPA, 1985).

The petroleum refining complex near Wood River is the third concentration of hazardous materials-related industry in the Alton area. Standard Oil (Amoco), the first of the major refiners, opened operations in 1908 when it began refining crude oil into gasoline, kerosene, lubricants, and other by-products. Initial capacity was 7,500 barrels a day. In 1913 the company installed Burton-Humphreys cracking stills and later replaced them with improved tube stills (Amoco Oil Co., n.d.). Each phase of process improvement increased production and by the late 1960s the Wood River refinery could refine 73,000 barrels daily. Before the plant closed, it was generating 450 tons of RCRA wastes in 1984 (IEPA, 1985).

Two neighboring refineries are the Shell Oil Company (originally Roxana Oil Company) and Clark Oil (formerly Wood River and Sinclair). Shell constructed its main Midwestern refining operation on the American Bottoms in 1917-18 and during its first year of operation produced sixty-six million gallons of fuel oil, eleven million gallons of gasoline, and thirteen million gallons of kerosene distillate (Beaton, 1957: 146-7). The company added several Trumble Units during the next decade and boosted capacity to 45,000 barrels a day. The Wood River plant was the site of extensive experimentation with solvent extraction during the 1930s and later became a major source of lubricants for Shell. The capacity continued to increase, and by the late 1960s, the plant had the capacity to handle 200,000 barrels per day (Shell Oil Co., 1968). Clark Oil's refinery began operation in 1941 as the Wood River Refinery. It later became part of the Sinclair Oil Corporation in 1950 and Clark purchased the operation in 1967. At that time, the capacity of the Hartford refinery was 31,000 barrels per day. Since the Clark acquisition, the total capacity of the plant has more than doubled. Components of the refinery include a Catalytic Cracking Unit, an Alkylation Unit, and a Coking Unit (Clark Oil Company, n.d.). Together the two plants are capable of generating in excess of 900 tons of RCRA wastes annually (IEPA, 1985).

A third refinery in the vicinity of Wood River was the White Star Refining Company. The short-lived venture began operation in 1919 and was forced to close in the mid-1930s. Shell Oil purchased the site and now operates its sulphur plant there.

A final source of hazardous materials was the International Shoe Company which operated a tanning plant in Hartford from 1917 until 1964. Chromium wastes and tannic acids are typically associated with fine leather tanneries and were found in water samples taken near the plant in the 1920s (Illinois State Archives, 1932).

2.4.2 The Tri-Cities Area

The Tri-cities area includes Granite City, the major population and manufacturing center of the complex, and two smaller communities, Madison and Venice (Fig. 2.3). This aggregation of industry typifies the establishment of company towns on the east bank of the Mississippi and it shares some of the problems created by the politically fragmented urbanized areas.

In 1892 the Niederinghaus brothers, owners of the St. Louis Stamping Company, decided to expand their family operation, and to do so, they searched for suitable property on the American Bottoms. They purchased land near where the Chicago and Alton and the Chicago and Peoria railroads merged. The site was slightly higher than the surrounding floodplain and also was situated near the soon-to-be-completed Merchants Bridge. The family commissioned a city plan and by 1894 workmen began laying out Granite City. Construction on the core industries, Markel Lead (now Taracorp), American Steel Foundry, St. Louis Stamping Works, and the Granite City Steel Works, commenced simultaneously. Factories began operation in 1895 and the newly-created job opportunities attracted workers from Missouri. Population grew rapidly, from zero in 1890 to over 9,000 in 1910, with 5,600 factory jobs in 1914 (Beuttenmuller, 1953-4: 151-5).

The dominance of the Niederinghaus family over all phases of city development, along with a higher risk of flooding in neighboring Madison and Venice, resulted in a concentration of industry in Granite City. The nearby towns grew largely as dormitory communities for workers in the Granite City mills, and by 1910 they housed some 8,700 residents. Venice was described as a settlement of "ramshackle houses" and "shanties on scows" (Taylor, 1915: 135). Madison, which predated Granite City, remained a separate entity although it was contiguous with the plan of the larger company town. Such political distinctions allowed nuisance-causing industries to operate in proximity to population centers without being subject to legal action from the communities they affected.

The sequence of factory openings chronicles the beginning of hazardous waste generation in the Granite City area. The first operation to go into production was the Niederinghaus' St. Louis Stamping Company (later NESCO) which manufactured enameled and galvanized tin ware. An open hearth steel mill opened soon afterward and it primarily produced steel plate goods. This plant, the Granite City Steel Company, added pickling, annealing, and cold rolling departments in 1900, along with gas producers for the open hearth ovens (Beuttenmuller, 1953-54: 199-202). Thus, by the turn of the century the Niederinghaus interests were producing a full range of hazardous wastes associated with steel mills.

Other sources of hazardous materials joined the steel mills by 1924. Two lead smelters arrived by 1910--National Lead (formerly United and Markle) and Hoyt Metal. St. Louis Coke and Iron (subsequently Granite City Steel Blast Furnace Division) initiated operations in 1921 and supplied not only the metal-working operations with pig iron, but also provided raw materials for coke by-product consumers. The F.J. Lewis Company (later Reilly Tar) produced coal-tar products, and Midland Creosote (later Jennison-Wright) used these in their wood-preserving operation (Austin, 1977). Such operations are typically linked to accumulations of phenols, PCPs, and coal tars (USEPA, 1985) and all have been operating more or less continuously since the early 1920s.

In neighboring Madison, Barber Asphalt and the Kettle River Treating Company had operations which consumed coke by-products and possibly left hazardous materials on site.

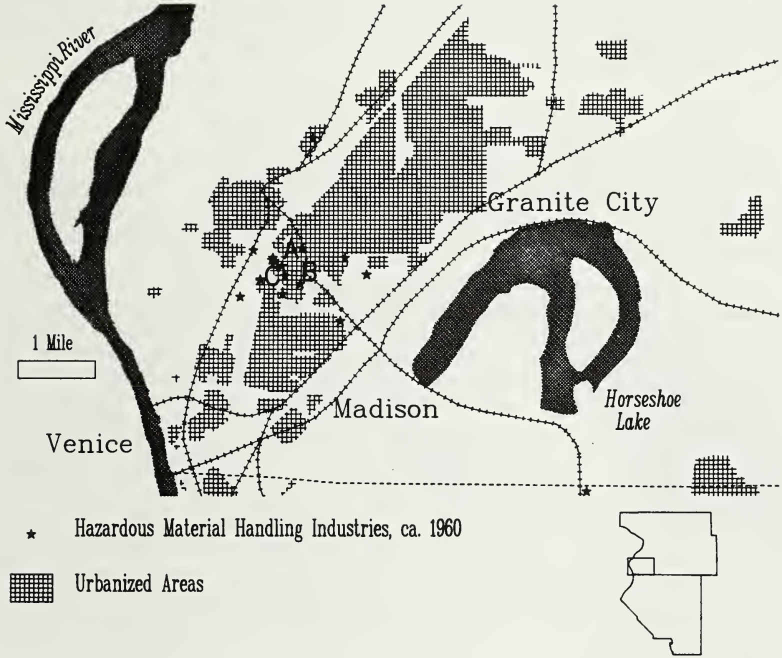


Figure 2.3. Hazardous Material Handling Industries in the Granite City Area, ca. 1960. A. Nesco, B. Granite City Steel Co., C. National Lead Co. Source: IMA, 1960.

During the years following 1930, Granite City industry was characterized by continued growth within existing plants, although the city attracted few new companies. The city remained dependent on local industry and particularly those established by the mid-1920s. Metal-working establishments continued to dominate the employment picture in the Tri-cities area through the 1960s. New additions to the older complex included several metal plating companies (Diamond and Finley), an aluminum processing operation (Dow and later Consolidated Aluminum), and an instant coffee manufacturer (Nestle).

2.4.3 The East St. Louis Area

The third industrial complex on the American Bottoms developed around the city of East St. Louis (Fig. 2.4). Originally the main transfer point for ferry traffic across the Mississippi River into St. Louis, East St. Louis developed as a rail hub, served as the residential center for neighboring manufacturing clusters, and eventually lost many of its important industries.

No other manufacturing complex in the Madison-St. Clair County area exemplified the fragmented political structure of corporate satellite cities as did the East St. Louis district. In 1859 the village of East St. Louis was incorporated, and in 1861 it merged with an adjacent community, Illinoistown. The newly-created entity provided services commonly associated with riverfront towns--freight handling and storage; room, board, and entertainment for travelers; and transportation services (IDOT, 1982; Bond, 1962; and Korsok, 1959). The railroads, which arrived during the 1840s and 1850s, had strengthened the position of East St. Louis as a focus for west-bound commerce, and in 1871 local businessmen began to develop a central livestock trading facility north of the city. They incorporated National City, a distinct political entity from East St. Louis, to house the stock yards, a traders' hotel, and several packing plants by 1900, yet had only a handful of residents. Thus, it was the first of the nearly exclusive industrial towns. It was followed by Fairmont City in 1914, Monsanto (currently Sauget) in 1926, and Alorton in 1944. Each of these corporate towns housed a major manufacturing concern, and was largely controlled by the central employer. East St. Louis housed a few manufacturing concerns along the rail lines, but its main function was that of a dormitory community for the factory towns surrounding it (Korsok, 1959).

Because many manufacturers were located in towns with a negligible base of opposition, they were essentially exempt from any nuisance laws and were thus free to operate without any restrictions on noxious odors or objectionable wastes. Such freedoms both attracted nuisance-causing industries to the east side and encouraged them to remain. The packing plants of National City were the first large scale example of this sort of activity. By 1930 large packing interests, such as Swift, Armour, Hunters, and Circle, were active in National City. The offensive qualities of packing plants were some of the first targets of sanitary reformers in the nineteenth century, but National City's operations suffered from few restrictions. In addition to the meat packers, rendering plants and fertilizer operations acquired property in National City and contributed to the large quantities of putrescible wastes of the packing plant city. The packing operations continued into the 1980s.

Other industrial operations grew up either around the fringes of East St. Louis or in adjacent towns. The village of Sauget to the south, originally Monsanto, housed the Commercial Acid works. Monsanto Chemical Company purchased the acid plant in 1917 and acquired a factory capable of producing acids, zinc chloride, phenol, salt cake, and nitric cake. By 1925 it had

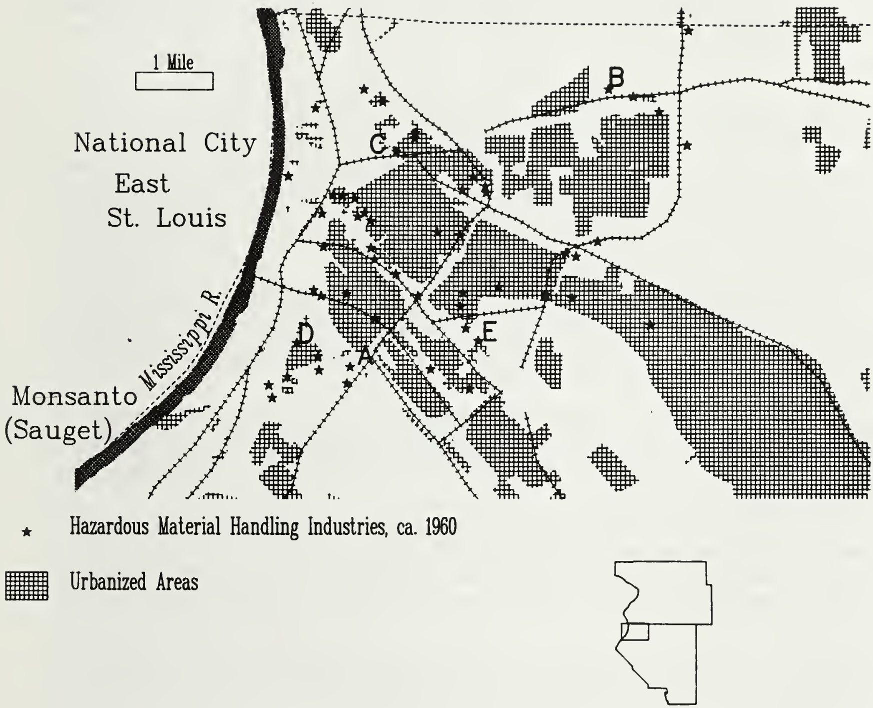


Figure 2.4. Hazardous Material Handling Industries in the East St. Louis Area, ca. 1960. A. Socony Mobil Oil Co., Inc., B. Allied Chemical Corp., C. Hammar Brothers White Lead Company, D. American Zinc Co. of Illinois, E. Aluminum Ore Company of America. Source: IMA, 1960.

added chlorine to its line of products and chlorobenzols the following year. A line of weed and brush killers was added after 1945, although the production of chlorobenzenes and phenols continued until 1970 when the phenol department was closed (Monsanto Chemical Company, n.d.). There was also a local gas works in East St. Louis from the late nineteenth century into the 1930s, and the 1919 census tallied four chemical manufacturers in East St. Louis. In addition, Socony-Vacuum (later Mobil) established a refinery in East St. Louis, and Allied Chemical had an operation in Fairmont City.

Metal working also clustered near East St. Louis. The Hammar Brothers White Lead Company opened their smelter by 1911 in the northwest corner of town and continued for at least the next two decades. American Zinc (currently Amax Zinc) commenced operations in 1914 and produced brass, prime spelter, sulphuric acid, and zinc oxide (Thomas, 1927: 93). The Aluminum Ore Company of America acquired a large tract of land immediately east of East St. Louis and established the town of Alorton as a base of operations for its aluminum production plant (operations commenced in 1903). There were also numerous foundries and steel fabrication plants serving the railroad industry in St. Louis.

Another major component of the East St. Louis industrial complex was the coal by-product industries. Asphalt roofing products as well as creosote operations also clustered near the rail yards. Paint pigment operations also consumed coal by-products and metals from the smelters (the 1919 census listed five producers of paints).

The East St. Louis industrial district typified the early twentieth-century satellite city described by Graham R. Taylor (1915). There was clear separation of residential and industrial land uses, and the large manufacturing tracts allowed reclamation of poor-quality property through waste dumping.

The vitality of this floodplain complex has been seriously eroded in recent years. National City currently houses no active meatpacking, and employment is down in most other factory districts. Closure of most of the rail yards, abandonment of the packing plants and associated fertilizer works, and modernization of chemical works have vastly changed the nature of the local job situation, but waste generation continues. Three of the older plants (Monsanto, Pfizer, and Cerro Copper) generated over 1,400 tons of RCRA wastes in 1984 (IEPA, 1985). Unrestricted disposal of these substances during the half century before regulation would have introduced tremendous quantities of hazardous wastes to the environment.

2.4.4 Upland Industries

The upland cities never developed the large-scale manufacturing that the cities on the Bottoms did; this came about because they could not offer the immediate proximity to the St. Louis market and labor force, the access to multiple railroads, or the copious freshwater supplies. Both Belleville and Edwardsville were also county seats, providing governmental services to surrounding agricultural and mining communities, and hence never acquired the dependence on industry characteristic of the floodplain cities. Yet, during the late nineteenth century and throughout most of the first half of the twentieth century, there was at least one hazardous waste source in each of the upland towns. Some no longer exist, nor have they existed since the creation of regulatory agencies.

One example of a defunct business is the Kettle River Treating Company's creosoting operation south of Edwardsville (Fig. 2.5a). By the early 1920s, local promoters were hailing it as one of the "world's largest" and it operated at least until 1960 (ESL Chamber of Commerce, ca. 1920 and IMA, 1960). Edwardsville's two other manufacturers which handled hazardous materials were the N.O. Nelson Manufacturing Company, which manufactured lead and brass plumbing and the United States Radiator Corporation. The Nelson Company acquired land for its operation and company town between 1890 and 1895 and reached a peak of 230 employees in the mid-1920s (FWP, 1936). By the late 1930s it was failing. The U.S. Radiator Corporation also enjoyed peak production during the 1920s and closed sometime before 1960.

Collinsville, although not a county seat, experienced limited industrial development (Fig. 2.5b). The first of the hazardous waste generators in Collinsville was the Reichenback Company, a manufacturer of zinc paint pigments which began operation in 1875. It became the Chemical Pigment Company in 1923 and by 1926 had acquired the name of St. Louis Lithopone (FWP, 1936, Sanborn Map Company, 1926). Used intermittently after that date, the paint pigment operations left a large deposit of barium-laden wastes on the south side of Canteen Creek (personal communication, David Webb). A second source of hazardous materials chose Collinsville as a manufacturing site to take advantage of coal prices and low population densities. In 1904 the St. Louis Smelting and Refining Company purchased over 200 acres of land northeast of Collinsville where they produced white lead, basic lead, sulphates, and lead cable. In 1935 the complete operation was dismantled and shipped to Argentina, yet lead slag deposits cover the ground at the former manufacturing site (Gill, 1964, and FWP, 1936).

Belleville was a more important manufacturing center than either of the other two upland cities (Fig. 2.5c). It boasted of its coal mining, a large brewery, and numerous metal-working operations. Between 1883 and 1929 seven foundries, three stove companies, and several primary and metal-finishing companies were founded in Belleville. One of the metal-working industrial cores was west of the intersection of Main Street and the Louisville and Nashville Railroad. A second cluster existed near Richland Creek southwest of the city square, and a third developed along the railroads west of town. Only two sources of RCRA wastes existed in Belleville in recent years and both companies began operations before 1930 (Marsh Stencil-1920 and Peerless Enamel-1928; IEPA, 1985 and Petty, 1939).

A final source of possible hazardous materials in the uplands area was Scott Air Force Base near Belleville (Fig. 1.3). The Army Air Corps established the base in 1917 as a pilot training facility. After World War I it had no regular assigned unit until it became the host installation for a lighter-than-air squadron during the 1930s. During World War II and after, the base resumed functioning as a base for heavier-than-air craft. The primary service of Scott Air Force Base since the 1950s has been as an air transport base (USAF, 1985).

Hazardous materials handled at the site include fuel, oil, PCBs, and solvents. Release of these materials to the environment could have occurred in the form of accidental spills, leaking storage tanks, or intentional landfilling. A review of past waste generation and waste disposal practices indicated three possible sources of environmental contamination at Scott (USAF, 1985). Further investigations have been recommended by the Air Force's study of the base.

Overall, the upland communities never generated the volume of hazardous substances attributed to the industrial complexes on the Bottoms, and the visible evidence of past hazardous waste-related activity is less apparent near the hill towns. Consequently, intrusion on the zones of former industrial activity is more likely in these zones and this has occurred.

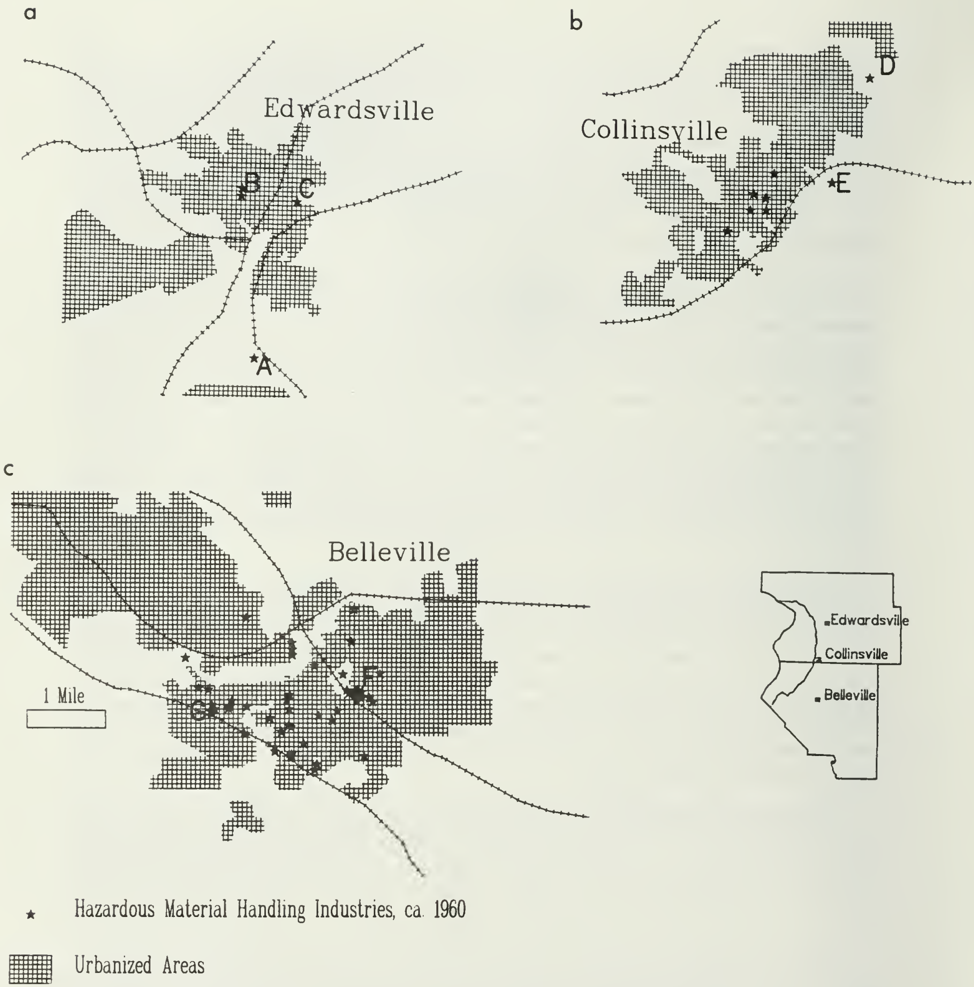


Figure 2.5. Hazardous Material Handling Industries in the Upland Cities, (a) Edwardsville, (b) Collinsville, (c) Belleville, ca. 1960. A. Kettle River Company, B. N.O. Nelson Manufacturing Co., C. United States Radiator Corporation, D. St. Louis Smelting and Refining Company, E. St. Louis Lithopone, F. Marsh Stencil, G. Peerless Enamel Products Co. Source: IMA, 1960.

CHAPTER 3-WASTE MANAGEMENT HISTORY

The development of policies to deal with general urban wastes in the East St. Louis region parallels the sequence observed at the national level (Tarr, 1984). Early twentieth-century concerns focused on putrescible wastes, and only in recent years has serious attention been devoted to non-biological industrial wastes. There were periodic attempts to control airborne emissions of factory wastes in the early twentieth century, but most of the objections to industrial smoke came from Missouri. Thus, attempts to control smoke were hampered by the limits of state and municipal jurisdictions. While St. Louis residents endured the seasonal effects of inversions and smokey skies, east side communities witnessed the accumulation of industrial solid wastes across the American Bottoms. Low marshy areas, meander scars, and abandoned stream channels provided excellent repositories for factory refuse, and the concentration of manufacturing on the Bottoms brought the source of wastes into position to utilize these topographic receptacles. With no restrictive regulations, industry operated in an uninhibited manner and contributed to a wholesale transformation of the floodplain. Filling of lakes and marshes was considered a form of land reclamation and a benefit to area residents and businesses. In addition, throughout most of the study period, factories were relatively free to release liquid effluent into the nearest water body. However, in recent years the effects of unregulated dumping have prompted a reexamination of old policies and the enforcement of new regulations.

3.1 Early Practices, 1870-1930

3.1.1 Municipal Concerns and Activities

City codes in the early 1900s reflected the Progressive-Era connection of moral order and civic cleanliness. These codes relied on "nuisance statutes" to control the possible outbreak of epidemic diseases and "immoral" behavior. Nuisances, broadly defined, included barnyard animals, standing water, offensive odors, and brothels. Implementation of nuisance ordinances effectively forbade the keeping of animals within the city, the dumping of biological wastes in the streets or in streams, and attempted to regulate the industries generating "obnoxious, prejudicial, or detrimental conditions." While these statutes limited the number of farm animals in towns and reduced the amount of garbage in the streets, exceptions were made to accommodate new industries. Granite City's municipal code, for example, prohibited manufacturers which were "noxious, offensive, or injurious," yet when the founding family decided to construct a gas works, the city council promptly granted an exemption (Granite City, 1906: 200). In contrast, nearby Alton, which was not a company town, specifically identified gas works as a nuisance-causing industry, although the law did not close the existing plant (Alton, 1909: 449).

Most attempts to regulate industrial activity focused on those which processed biological products and produced putrescible wastes. Codes specifically identified slaughter houses, packing plants, tallow works, soap plants, rendering works, tanneries, and distilleries as nuisance-producing industries. City codes generally restricted the operation of such manufacturing operations within the city limits, or within a specified distance of the city limits, unless a special permit was granted (East St. Louis, 1908; Alton, 1909). The main reason for such prohibitions was to prevent the accumulation of putrescible substances within the city and thereby reduce the possibility for epidemic diseases to fester in refuse heaps or waterways. The limitations of such codes are obvious in the East St. Louis region with the close proximity of numerous small political units.

Other potential industrial hazards were also addressed by local codes. Most communities prohibited the manufacture of explosives within the city limits and licensed vendors of gunpowder and dynamite. They also regulated the handling of explosive and flammable substances such as gasoline. Thus, city governments attempted to prevent or at least regulate the entry of certain hazardous materials within their municipal limits, yet they formulated more elaborate codes to establish guidelines for the proper removal and disposal of biological wastes (Alton, 1909; ESL, 1908; and Granite City, 1906).

Cities also regulated the dumping of domestic solid wastes, but again chose not to interfere with the dumping of factory solids. Scavengers had to seek permits to haul garbage and codes described proper procedures for moving the garbage through the city. In most communities, the statutes even forbade dumping within a certain distance of the city. Yet no mention was made of factory wastes (Alton, 1909; East St. Louis, 1908; and Granite City, 1906).

Smoke-related issues drew more attention during the early years of this century than solid or liquid factory wastes. In response to complaints, the Federal Lead Company in Alton raised the height of its smokestack to reduce the damage to trees downwind from the plant (**Alton Telegraph**, 3/28/1923). The lead smelter near Collinsville was also subject to numerous complaints and legal actions resulting from its toxic releases (Gill, 1964). Nevertheless, a general toleration of industrial smoke prevailed on the east side of the Mississippi River during the first third of the century.

Another perceived nuisance was domestic sewage, and municipal attempts to provide sewer service reflects the dominant concern with biological wastes. City codes began to outlaw privy vaults early in this century; in doing so, municipalities had to offer an alternative to local residents. Cities constructed piecemeal sewer systems to transfer domestic wastes from homes and businesses to nearby water bodies. Local codes prescribed the manner of sewer line connections and the licensing of plumbers; they even demanded that factories connect their toilet facilities to the local sewers. The overwhelming concern with biological wastes was not matched in terms of non-biological factory wastes. Other than the nuisance statutes, there were virtually no regulations requiring industries to sewer their effluent along with domestic wastes. Furthermore, lifting wastes into the Mississippi River required expenditures to run the pumps, and by limiting factory effluent in city sewers, municipalities extended the life of their equipment and reduced the operational costs.

The physical construction of sewers came about as a result of increasing population densities in the towns of Madison and St. Clair counties, Progressive-Era politics, and developments in public health practice. Most cities initially allowed residents to construct privy vaults or cesspools on their property or to rely on natural drainage courses. Edwardsville had no sewage system in 1886, although there was one public sewer 200 feet long; but there were no regulations requiring home owners to tie into the main sewer. A State Board of Health report described local practices this way: "Houses drain through cemented socket tiles into natural drains" (Illinois State Board of Health, 1886). However, as the density of residential areas increased, contamination of neighboring wells became common. Two solutions to tainted water supplies were tried: potable water derived from pure sources and public sewer systems. Alton began the process of developing a city-wide sewer system in 1895, and by 1912 the system was at least partially in operation. The problems created by cesspools remained however, for in 1912 the city council debated an ordinance to prohibit cesspools on property fronted by sewer lines (**Alton Evening Telegraph**, 3/5/1895; 3/20/1912).

East St. Louis residents originally relied on shallow wells to obtain their drinking water, but in 1886 the East St. Louis Interurban Water System was formed to distribute water throughout the city. By the end of the year they served 156 customers and two years later had completed a pair of large settling basins near the riverfront to filter water before delivery (Granite City Jubilee, 1971: 96). A sewer system came about several years later and for different reasons than in Alton. The flood of 1903 inundated much of East St. Louis and prompted numerous attempts to prevent future flooding. The city constructed a protective levee and a "gigantic outlet sewer" to dispose of the city's sewage and flood water (Wilderman and Wilderman, 1907: 755). The low elevation of East St. Louis required that pumps be installed to force the sewage over the levee and this situation has caused continual problems for the removal of sewage from the towns on the American Bottoms.

As in the case of East St. Louis, installation of sewers lagged behind construction of a water supply system in Granite City. When the city streets were laid in 1895, public water lines were also installed. Several years passed before the city council even discussed the question of installing sewers. In 1899 the council approved a plan for a city-wide sewer system and opened bids on the project (Granite City, 1896-1899). As in each of the other cities within the study area, the sewer lines served the domestic neighborhoods and simply carried untreated sewage to a convenient sink; in the case of Granite City and East St. Louis this was the Mississippi River (National Resources Committee, 1937).

Upland residents faced slightly different problems, although they generally relied on similar solutions. Combined sewers, constructed to handle both storm and sanitary sewage, served residential areas exclusively. Belleville constructed one of the first municipal treatment facilities in the two-county region (ca. 1903). The city sewers directed sewage to a large septic tank for biological decomposition of domestic wastes, although by 1916 the septic system was overloaded and declared a nuisance (**Belleville Advocate**, 1901-1916). This inadequate system continued to pollute Richland Creek into the 1930s (**Belleville Daily Advocate**, 8/21/1934). Collinsville installed a similar sewer and septic system which ultimately drained half the community into Canteen Creek. As in Belleville, complaints filed by downstream landowners identified the municipality as a source of water pollution (Rivers and Lakes Commission, 1915).

As cities grew, they struggled to extend sewer systems to new neighborhoods, although immediate delivery of such services was not always possible. In fact, timely extension of urban infrastructures commonly lagged behind residential development (Rosen, 1986). East St. Louis announced plans to extend and improve its sewage removal system in 1925 ("Engineering Work," 1925). Yet, surrounding communities such as Landsdowne and Edgemont remained inadequately served a decade later. Alton considered releasing the sewage of new neighborhoods into sinkholes until it was determined they drained into the Mississippi River near the city water intake (Lamar, 1927). The Tri-cities area also was in need of relief sewers in the mid-1930s, as was Collinsville (NRC, 1937). Such short-comings indicate cities were unable to tend even to the wastes they perceived as hazardous, let alone industrial discharges.

The fragmented political nature of the American Bottoms also impeded the creation of a comprehensive sewage removal system. In 1908 the East Side Levee and Sanitary District (ESL&SD) became the first public area-wide organization to attempt to resolve the problem of political fragmentation. Created several years after the 1903 flood (1907), the ESL&SD developed a plan to provide flood protection and drainage for an area in parts of Madison and St. Clair counties, including both the Tri-cities area and East St. Louis. The goal of the organization

was to divert Cahokia Creek through a canal north of the industrial communities, construct a complete set of levees along the Mississippi River, and divert runoff from the uplands through a second canal along the western face of the bluffs (ESL&SD, 1910). Although one of the proposed objectives of the ESL&SD was to provide public health services in the form of sewage removal and drainage of stagnant water bodies, its main purpose was to provide flood protection. Nevertheless, it provided a somewhat consolidated system for removing untreated sewage. The Wood River Drainage and Levee District, formed in 1912, centered on the Wood River industrial district and was chartered specifically to provide flood protection, not sanitary services.

The overall condition of urban sewage removal throughout the Madison/St. Clair region in 1930 was typical for the early twentieth century. The sewer systems primarily served domestic customers, collected storm and sanitary sewage into combined drains, and delivered the untreated effluent to convenient waterways. Cities seldom extended public works services as rapidly as outlying districts grew, and those communities with treatment facilities generally overtaxed their limited capacity. Further, the low-lying communities of the American Bottoms faced additional difficulties. Reliant on pumps to remove overflow and sewage, the ESL&SD suffered chronic pump failures during periods of high river stages. This resulted in the accumulation of sediments in backwater lakes and abandoned stream channels when overflow could not be pumped into the Mississippi River. Thus, despite intermittent attempts to provide some form of sanitary sewage service, cities in the study area were only partially served.

3.1.2 Management of Industrial Wastes, 1870-1930

The methods of waste "management" were relatively simple during the early twentieth century: most wastes simply were dumped. Some care was taken to prevent accumulations from interfering with manufacturing processes, and with the adoption of by-product coke ovens there was waste reclamation activity during the 1920s (Gold, et al., 1984). Yet, most wastes were unwanted and perceived as relatively harmless. Consequently, disposal in watercourses and topographic depressions remained the order of the day until well after 1930.

Slaughter houses and packing plants in National City generated large quantities of putrescible wastes, but they also contributed to early waste recovery programs. The St. Clair Board of Supervisors identified Cahokia Creek, which flowed through the stock yards of National City, as a "great menace to East St. Louis" and resolved to create a committee to study the diversion of the creek away from the residential areas of East St. Louis (St. Clair County Board of Supervisors, 5/7/1904). Despite a strong resolve to remedy an offensive situation, the East Side Levee and Sanitary District (ES&LD) reported that "firms and corporations have . . . encroached upon the channel of said Cahokia Creek and obstructed the same so that filth and stagnant pools of water accumulate and stand and contribute a menace to the health of the inhabitants" (ESL&SD, 5/5/1915: 1153). The board ordered their attorney to issue notices to the companies obstructing the creek that they must reopen the channel at their own expense. The following year, however, complaints against the meat packers were filed with the Illinois Rivers and Lakes Commission (1916). By 1925 the stock yards and National City industries had private sewers directing their effluent to the Mississippi River ("Engineering Work," 1925). Although this marked a different method of moving their wastes to the river, the ultimate repository remained the same. Nonetheless, local residents were spared the offensive odors associated with the open Cahokia Creek sewer.

Numerous fertilizer plants, rendering operations, and the tannery in Hartford are examples of early waste recovery methods associated with meat packing. These plants consumed the bones, fat, and hides of the cattle and hogs slaughtered in National City. While these operations consumed a large volume of the biological wastes of the packing industry, there were still sufficient quantities of unused wastes to prompt complaints.

Large metal working plants--Granite City Steel, Laclede Steel, Aluminum Ore Company, St. Louis Smelting, and National Lead--all generated substantial volumes of solid wastes. The slag and dross of their operations were used to fill low places on their property or sold for reprocessing or filling off site. The Aluminum Ore Company dumped its slag and sludges into the western end of Pittsburg Lake between 1907 and 1927 (Thomas, 1927: 95). "In the early days the red-mud disposal was made by a little car traveling over narrow gauge tracks under mule power to the edge of the lake. This method was supplanted by a little saddleback locomotive and u-body dump car, still later by pumping" (FWP, East St. Louis File, 1936). After twenty years of such activity, the company had filled only a small portion of the lake and felt that it would remain a satisfactory refuse pit for many years to come (Thomas, 1927: 95).

The ESL&SD used hundreds of railroad carloads of slag from the Granite City steel mill to create revetments during the construction of levees. Between 1914 and 1917, the Board of Trustees reported receiving slag which was heaped up along the banks of the Mississippi River between the northern edge of the district (at the diversion channel) to the riverfront in East St. Louis (ESL&SD, 1914-1917). Laclede Steel built up its low-lying site with its solid wastes and St. Louis Smelting dumped its lead dross on its site where it remains today (beneath a residential development northeast of Collinsville; personal observation). Water passing over and through the slag apparently dissolved lead and carried it into a nearby creek. This caused reports of lead poisoning by people who consumed the Collinsville water (ISWS, Ground-water Section, Collinsville Folder, 1912).

Liquid wastes from the primary metal works contained acids, dissolved metals, phenols, oils, and cyanide (Federal Water Pollution Control Administration, 1967). These wastes were disposed of by a variety of means. Some were discharged to the Mississippi River as in the case of Laclede Steel and American Steel Foundry in Granite City (ISWS, Ground-water Section, Granite City File, 1913) and other facilities made settling basins or evaporation ponds on site for waste treatment (ISWS, Ground-water Section, Granite City File, ca. 1920 and Sanborn Map Company, Alton, 1915). Discharge of acidic wastes into large rivers was considered a safe means of disposal in the early twentieth century. This sentiment was summarized by W. T. Sedwick, an early leader in sanitary engineering, in his testimony on pollution of the Illinois and Mississippi rivers: "the pouring of a large quantity of acid from manufacturing wastes . . . might destroy typhus germs" (Leighton, 1907). Despite an incomplete accounting of all primary metal manufacturers' liquid wastes and given the contemporary attitudes, it is likely that most were released into waterways without treatment.

The oil refineries in the vicinity of Wood River and East St. Louis were another major source of industrial wastes by 1920 (Fig. 3.1). They produced acid sludges, boiler washes, and oily waste waters. Standard Oil (Amoco) installed a sewer from its Wood River site to the Mississippi when it built its refinery (1908) and used this facility to remove its effluent. Initially, Roxana Oil (Shell) allowed its liquid wastes to drain through ditches into Grassy Lake, although it too eventually constructed a sewer to the Mississippi River (ISA, 1932: 15). Both refineries continued their

Figure 3.1. Documented Hazardous Material Disposal Before 1930. Sources: ISWS, Ground-water Files; IEPA, Water and Land Division Microform Files; and additional sources mentioned in text.

discharges into the Mississippi River through the 1920s. Pressure from the Illinois Sanitary Water Board (formed in 1928) prompted both to install separators in 1935 and thereby decrease the amount of oil flowing from their sewers ("Abatement . . . ," 1936: 18).

A neighboring refinery followed a less costly method of waste disposal which brought about legal action to halt the open dumping of its effluent. White Star Refinery constructed its plant in 1919 and installed no sewer to the Mississippi River. The company dug a series of lateral ditches across their property and connected them to a larger ditch which drained into the northern end of Grassy Lake (Fig. 3.1). They allowed "escaped oil and the heavier refuse" from the refining operation to flow through the open sewers. At some time during the 1920s they installed "traps" to collect some of the oily wastes, and began to store heavy sludges and wastes in pits on their property. Periodically, the company burned the collected refuse, but the collection system did not prevent all oil and acids from leaving their property. By 1925 vegetation in Grassy Lake "began to wither and die," and this in turn deterred waterfowl from visiting the popular sportsman's lake. In addition, a layer of "thick or heavy oily substance" four to five inches thick settled on the bottom of the northern portion of the lake's bed. Chemical analysis of the lake's water indicated the Hartford tannery released chromium into the lake as well. Oil floating on the lake's surface allowed fires to erupt in 1925 and 1928 (ISA, 1932: 15-20 and **Alton Evening Telegraph**, 7/13/1928: 1). In fact, the 1928 fire raged out of control for more than six hours and engulfed several storage tanks of the White Star Refinery (**Alton Evening Telegraph**, 7/13/1928: 1-2).

In 1929, owners of property containing a portion of Grassy Lake filed an injunction against the refinery to halt their discharges into the lake. A Madison County Master in Chancery found White Star Refinery guilty of maintaining a nuisance and ordered the refinery to halt its discharges to the lake. A year later the state supreme court upheld this ruling (ISA, 1932: 21-23; and ISA, 1933). The court, however, awarded no damages to the landowners nor did they prescribe a remedy for controlling the discharge from the refinery. Nevertheless, the court action effectively closed the refinery which went out of operation in the mid-1930s.

The Socony-Vacuum Company (Mobil) refinery in East St. Louis received little attention from either the Rivers and Lakes Commission or the Sanitary Water Board; hence, there are no clear indications how it handled its wastes. Situated downstream from the St. Louis and East St. Louis water intakes, it may have been free to discharge wastes into the Mississippi River without attracting attention.

Other chemical and manufacturing plants in the East St. Louis vicinity were able to do just that. In 1932, the village of Sauget proposed to extend its sewer system to serve both the Monsanto and Federal Chemical companies, although the system offered no treatment (ISWS Files, Ground-water Section, Sauget, 1932). Liquids and some solids were dumped on site as indicated by a 1942 plan of the Monsanto plant revealing that a pair of "toxic dumps" along with a "phenol residue dump" existed on the company property (ISWS Files, Ground-water Section, Sauget, 1942).

Other documented incidents of industrial waste disposal point to unchecked use of waterways before 1930. Wastes from an artificial leather (scrap leather pressed and glued into shoe soles) works near Caseyville killed fish in Canteen Creek and rendered the water useless for livestock consumption (ISWS, Ground-water Section, Granite City File, 1912). Richland Creek pollution in 1915 was attributed to municipal sewage and also brewery slop, rendering shop wastes, and coal mine runoff (ISWS, Ground-water Section, Belleville File, 1915).

A source of long-term hazardous substances were the local gas works in most of the larger towns in the study area. Erected during the mid- to late-nineteenth century, they produced coal gas for street lights. The East St. Louis Gas Works was built in 1874 and operated until sometime between 1911 and 1928. Archaeological excavations indicate oily sands still exist underneath the site (IDOT, 1982: 192-198). Alton, Granite City, Edwardsville, and Belleville also had gas works which are likely sources of hazardous materials.

3.2 Recent Waste Management History, 1930-1980

During the last half century there has been a marked increase in the sewage treatment service available to municipalities and industries in the East St. Louis region. Federal funding for Works Project Administration and National Recovery Act projects brought about initial advances in the construction of public sewers and treatment facilities. Piecemeal construction throughout the 1940s and 1950s was followed by changes in federal and state water pollution regulations in the 1960s which prompted modernization or construction of municipal treatment works. The shift in focus from water quality to effluent limitations during the 1970s encouraged further improvements, both in terms of municipal facilities and industrial treatment practices.

3.2.1 Municipal Wastes and Treatment Services

As late as 1937, the National Resources Committee surveyed municipal waste treatment facilities in the St. Louis region and concluded that "[a]t present all sewage and industrial waste from the communities in the St. Louis region are discharged into the Mississippi without any treatment "(NRC, 1937: 65). Towns discharged their domestic, storm, and industrial sewage via water carriage systems built as the communities grew. The NRC expressed grave concern with the inadequate sewer capacity and the need for sanitary sewers on the east side of the Mississippi River. Their recommendations included preparation of plans and construction of improved sewer systems and treatment plants for most of the east side communities (NRC, 1937). Construction of treatment facilities took place in Collinsville, Belleville, and Edwardsville, while cities on the American Bottoms were unable to receive any improved service (Fig. 3.2a; Illinois Sanitary Water Board, 1949). State-wide, Illinois increased the proportion of its cities receiving sewage service from 44 percent in 1930 to over 90 percent fifteen years later (IEPA, 1970). The larger population centers of the region remained without sewage treatment, although for the state as a whole, the percentage of residents served by treatment works rose dramatically during this period (IEPA, 1970).

The absence of treatment in cities on the American Bottoms became apparent in the early 1950s when commercial fishermen on the Mississippi River complained of foreign tastes in their catch. They expressed concern that the undesirable tastes were the result of municipal and industrial sewage dumped into the river in the vicinity of St. Louis. A survey of pollution sources revealed the haphazard approach to the removal of urban sewage. There were forty-five sewer outlets on the Illinois side of the river between Alton and Monsanto (Sauget), and all the municipal outlets were combined sewers, handling storm and sanitary wastes. Illinois communities in the study area provided *no* treatment of the 164 million gallons of general urban sewage released into the Mississippi River daily (Bi-State Development Agency, 1954).

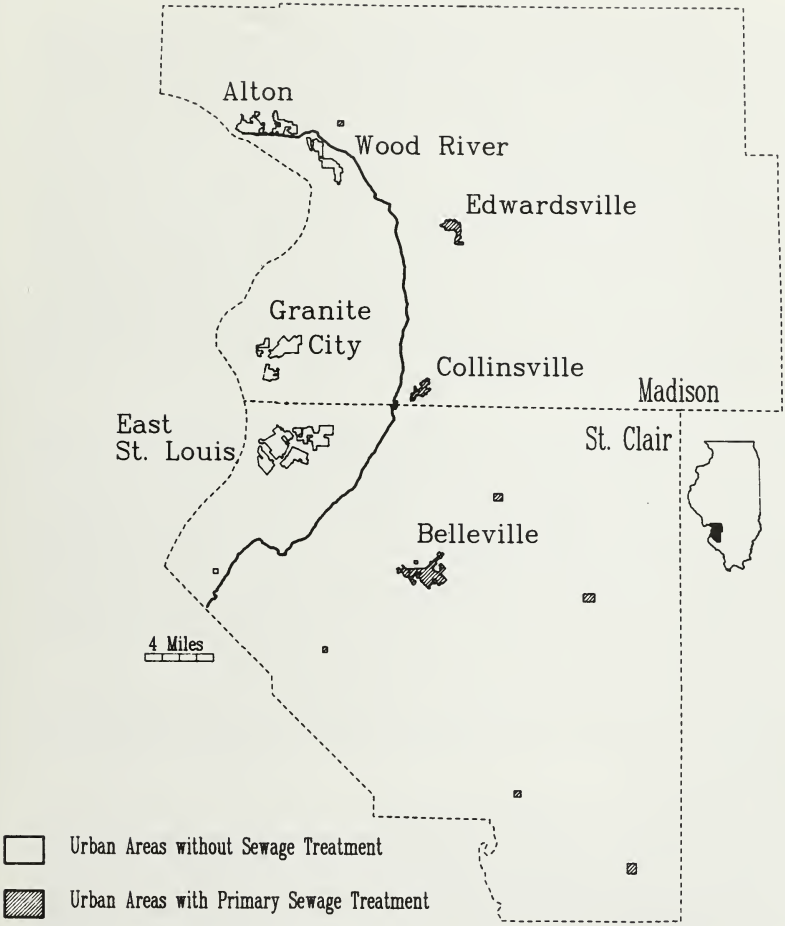


Figure 3.2a. Municipal Waste Treatment Service Areas, 1949. Source: Illinois State Sanitary Water Board, 1949.

There was no appreciable improvement in the manner of municipal waste treatment between 1949 and 1957. The U.S. Department of Health, Education, and Welfare's accounting showed that only the upland towns in Madison and St. Clair counties had primary treatment facilities (USHEW, 1957). A similar survey compiled in 1962 indicated that the oil refinery towns of Hartford, Roxana, and Wood River had added primary treatment (Fig. 3.2b), but the other industrial centers on the American Bottoms remained without treatment (USHEW, 1962). By 1971 progress had been made however (Fig. 3.2c). Alton completed its primary treatment facility in 1967, and East Alton and Granite City also had installed sewage treatment works (Southwest Illinois Metropolitan Area Planning Commission, 1971). Alton's plant treated primarily domestic wastes. Granite City's plant handled industrial wastes from all but one factory in the city (Granite City Steel), but the strength and quantity of the industrial discharges caused periodic damage to the facility (SIMAPC, 1972: 66-69). Improvements installed during the 1960s reflected plans drawn up by federal and state authorities to insure primary treatment by late 1967. The Sanitary Water Board was already calling for secondary treatment by 1982 when Alton became the last city in Illinois to initiate operation of its primary plant (IEPA Files, Div. Water Pollution, Correspondence 1/7/1969, C.W. Klassen to Alton Mayor).

The city of East St. Louis began operating a primary treatment plant in 1966, but industrial wastes which were improperly accepted by the plant rendered it unserviceable by 1967. With federal support, East St. Louis was able to repair the plant and resume primary treatment by 1971 (**ESL Journal**, 1/13/1971). Troubles continued to plague the East St. Louis sewer system, however. New sewers on the south side of East St. Louis initially were connected to trunk lines which bypassed the treatment facility, and high flood stages caused interruptions in service (**ESL Journal**, 6/18/1973). Both situations allowed untreated wastes to enter the Mississippi River temporarily, and part of the untreated effluent included industrial wastes. The East Side Levee and Sanitary District served communities surrounding East St. Louis, including Venice, Cahokia, Centreville, Alorton, Fairmont, and Edgemont, and by the early 1970s, the ESL&SD had four primary treatment plants within its service area (**ESL Journal**, 1/13/1971).

The village of Monsanto (Sauget) completed its sewage treatment plant, at the urgings of the Sanitary Water Board, in 1966. As originally designed, the plant was a primary treatment facility and was intended to serve both the domestic users and seven major manufacturers in Monsanto (**ESL Journal**, 5/27/1966).

Upland communities pioneered the adoption of primary waste treatment and also secondary waste treatment. Collinsville, Belleville, and Edwardsville all had secondary facilities in 1971, while among the lowland towns only Roxana and South Roxana could offer such service (SIMAPC, 1971). By 1978 Granite City had added secondary treatment, but primary treatment remained the dominant form of treatment for larger communities. Treatment of domestic wastes in small, dispersed rural hamlets and subdivisions became much more common during the 1970s (SIMAPC, 1978).

The overall progress of municipal waste treatment during the past half century has seen the incorporation of more areas within the zone served by treatment facilities. A larger share of the wastes are now receiving secondary treatment, although joint treatment of municipal and industrial wastes has declined with the rise of effluent guidelines. It must be emphasized, however, that treatment plants designed to handle domestic wastes did little to reduce toxic pollutants in municipal waste streams (Miller and Burch, 1981).

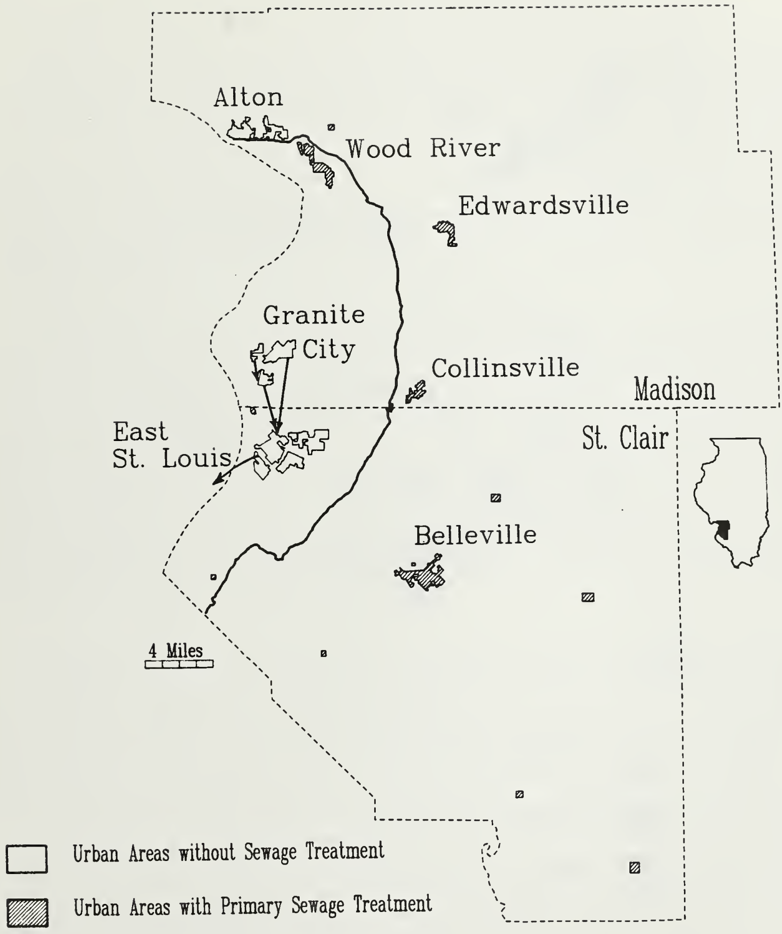


Figure 3.2b. Municipal Waste Treatment Service Areas, 1962. Source: USHEW, 1962.

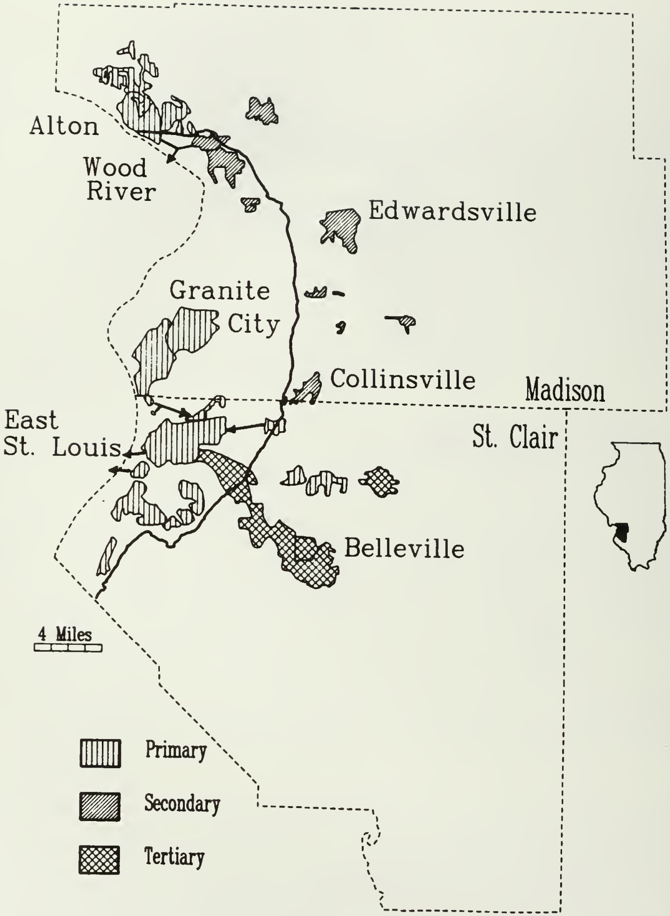


Figure 3.2c. Municipal Waste Treatment Service Areas, 1972. Source: SIMAPC, 1972.

3.2.2 Industrial Waste Management, 1930-1980

There was an unprecedented amount of research conducted during the 1930s on the treatment of industrial wastes. Researchers remained convinced that natural stream self-purification would clear waterways, but they faced increasing loads of biological wastes. As a consequence, sanitary engineers focused their efforts on the treatment of effluent carrying large quantities of putrescible substances, which constituted the largest share of industrial discharges. Furthermore, factory wastes constituted only half the total volume of all urban sewage; hence, putrescible wastes remained a research priority (Eldridge, 1942: 1-4). There was growing concern with acidic and phenolic wastes, but recovery rather than treatment was seen as a solution. A search for marketable by-products proved futile, and without a return on their treatment investment, factory managers were reluctant to install treatment facilities (Colten, 1988).

Throughout the 1950s, sanitary engineers encouraged the adoption of primary and sanitary treatment facilities, although textbooks on industrial waste treatment continued to emphasize the need to treat biological wastes. Advocates of waste treatment took a slightly stronger position than in past decades. Willem Rudolfs (1950: 5), a pioneer in industrial waste management research, not only supported waste management, but he proclaimed that it should not be a secondary concern of industrial managers. Instead, he stated it should be considered an integral part of the production process. By the 1960s, environmental engineers insisted that factories should construct waste treatment facilities as part of their plants, despite short-term costs (Nemerow, 1971). Such statements reflected the passage of federal water pollution control laws, but also suggest the underlying frustration endured by environmental engineers who had to convince factory owners to treat their effluent (Petulla, 1987). Short-term costs remained a vital concern to management and, when possible, inexpensive treatment systems such as lagoons took precedence over more sophisticated technologies.

While industrial effluent composed 50 percent of all liquid sewage nationally, in heavily industrialized areas the proportion was higher. In the St. Louis region, approximately 80 percent of all public sewage came from industry--and almost none received treatment in 1954 (Bi-State Development Agency, 1954). The five factory waste streams analyzed by the 1954 study contained more than 41 million gallons of effluent daily. The two refineries in the survey (Shell and Standard) had separators which removed surface oil from their discharges. International Shoe had lagoons in place and also weirs to remove solids from the overflow from its lagoons. The survey mentions no other primary treatment facility. Chemical analysis of the effluent indicated high phenol and oil concentrations in the vicinity of the outlets from the refineries, East St. Louis, and Monsanto (Sauget). Both East St. Louis and Monsanto (Sauget) sewers carried effluent from local manufacturers. Granite City sewers also handled untreated factory sewage, but analysis did not reveal high concentrations of phenols or oils there (Bi-State Development Agency, 1954). While this early survey does not present a complete accounting of industrial waste management practices, it indicates that there was only minimal treatment and the level of treatment had changed little since the mid-1930s when the refineries first installed oil collecting devices.

A few years later, another survey compiled a slightly more detailed listing of waste treatment facilities, although it showed little change in how liquid wastes were handled. In the Alton area, Laclede Steel, American Smelting, and Owens-Illinois all discharged their untreated wastes into the Mississippi River. Alton Box Board took "good housekeeping" measures to prevent its

effluent from entering the river--exactly what those measures were is uncertain, although in later years they employed lagoons. Western Cartridge (Olin) provided no treatment for its wastes before releasing them into Wood River (USHEW, 1957).

Despite the fact that the Wood River area refineries had separators to collect oily wastes from their effluent, these systems were not infallible. In 1948 the East St. Louis Interurban Water Company complained that "[f]or a period of several weeks oil wastes from the Wood River refineries have been entering the Mississippi River in quantities far beyond the normal tolerance rate" (IEPA, Div. Water Pollution Files, Correspondence, 12/21/1948). Over the course of the next few years, there were repeated incidents of phenol releases tainting the East St. Louis water supply. The Sanitary Water Board rebuked St. Clair Refining Company in 1950 and Sinclair Oil Company in 1951 for allowing phenols to enter the river (IEPA, Div. Water Pollution Files, Correspondence 12/20/1950 and 12/26/1951). In an effort to curb the problem, the Sanitary Water Board requested discharge measurements and analysis from Standard Oil. The refinery complied, reporting that their separators collected 18,011 barrels of oil during January of 1953 and that the effluent entering the river contained only 30 parts per million of oil (IEPA, Div. Water Pollution Files, Correspondence, 2/10/1953). Closer scrutiny by the Sanitary Water Board induced the refineries to construct lagoons as waste management facilities. Sinclair Oil Company installed its aeration lagoon in 1956, Standard (Amoco) began using lagoons at about the same time, while Shell added a trickling filter and lagoons in 1958 (**ESL Journal**, 12/24/1981). The Shell Oil Company system was designed to eliminate phenols, sulfides, oils, and mercaptans, and the aeration basin and retention ponds were lined to prevent percolation of waste liquids into the soil. The design also called for sludges and skim oil to be returned to the refinery for further processing (Russel, Russel, and Wenger, 1957). Although the refineries reduced their releases to the Mississippi River, the accumulation of oils and toxic metals took place in the lagoons.

Industrial waste treatment was virtually absent in the Granite City area through 1960. Although the Koppers Coke Works installed a primary treatment system in the 1940s, it was abandoned shortly thereafter. In the early 1950s, the coke company impounded gas-wash water with the intent of recovering iron ore, but large quantities were released directly to Horseshoe Lake (ISWS, Ground-water Section, Correspondence 7/12/1951). The 1957 survey of waste treatment facilities showed no Granite City industries treating their wastes before the local sewage system pumped them into the Mississippi River (USHEW, 1957). Several years later, Granite City Steel announced plans to construct its own treatment works to handle its 35 million gallons per day of wastes. The city continued to pump the wastes of other industries. This included chromium- and nickel-laden wastes from Diamond Plating, a chromic acid solution from NESCO, and National Lead's cooling water. The total volume of effluent from Granite City manufacturers was 9.6 million gallons a day. In addition, a scavenger service periodically hauled away paint sludge from the A.O. Smith Company, a manufacturer of automobile frames (Sheppard, Morgan and Schwaab, 1961).

A 1942 survey listed the following East St. Louis area industries:

Monsanto Chemical	Federal Chemical
American Zinc	U.S. Chemical Warfare Service
Lubrite Refining	Darling Fertilizer
Lewin Metals	Union Electric
Sterling Steel	Midwest Rubber Reclaiming.

Before and during the 1950s, they had no municipal treatment available. Monsanto (Sauget) area industries reportedly discharged wastes into the open ditch (Dead Creek) flowing to Cahokia. Residents along the creek sued the industries and won a $4,000 nuisance award. Yet the Illinois Sanitary Water Board report concluded that it "is felt that even though industrial wastes would have a slight odor their discharge to the ditch would be beneficial since the great volume would flush settled solids into the Mississippi" (IEPA, Div. Land Pollution Files, Hasfurther, 1942:1-2).

A follow-up survey of industrial discharges in 1947 identified several primary waste management procedures being used in the East St. Louis area. Since 1945, Socony-Vacuum Oil Company (Mobil) had removed oil from its waste water (**ESL Journal**, 12/42/1981), and the 1947 survey reported that the company produced no acid sludges and sold all its caustic treating solution to another company which reclaimed the phenols (IEPA, Div. of Land Pollution Files, Troemper, 1947: 4-5). American Zinc recovered various by-products and allowed only cooling water and small spills to escape to the Mississippi. The Moss Tie Company discharged all process wastes to a lagoon on site where they were allowed to "seep into the soil." Midwest Rubber Reclaiming Company released naptha, sulfides, polysulfides, and pine tar into its sewage which entered the Mississippi River. Although the report did not determine which industries were responsible for causing river fish to taste foul, it suggested that Midwest Rubber, Monsanto Chemical, and Socony Vacuum were the most likely sources (IEPA, Div. of Land Pollution Files, Troemper, 1947: 2-6).

By the late 1950s Monsanto Company practiced "good housekeeping" (USHEW, 1957). Sewer plans and company blueprints suggest good housekeeping consisted of sewering liquid wastes to the Mississippi River and landfilling solids on site. The 1959 liquid waste stream contained high concentrations of phenols and aromatic compounds (IEPA, Div. of Water Pollution Files, Enviro-Chem Report, 1972). Company records document an "Old Toxic Dump" in 1945 (IEPA, Div. Water Pollution Files, Monsanto Plan, 1945). Numerous other landfills have been identified in the course of recent investigations by the IEPA (Ecology and Environment, 1986). Pfizer Pigments (the G. S. Mempham Corporation produced pigments at the same site as early as 1920) released its acidic wastes into the East St. Louis sewer system, and this practice continued even after the city built its treatment plant in 1966 (**ESL Journal** 7/2/71).

By the early 1970s, both Sauget and East St. Louis had installed some form of primary waste treatment, but it did not destroy the toxic metals and phenolic compounds contained in the waste streams handled by those plants. Consequently, commercial fishing was non-existent between St. Louis and Cape Giradeau (IEPA, Div. Water Pollution Files, USEPA Hearings, 12/7/1972).

Industrial waste management progressed from a negligible presence on the American Bottoms in the early 1930s to a slightly more common feature by 1970. Simple filtration or skimming devices constituted the dominant types of equipment employed by industries and cities in the area. Their creation of sludges and collection of sediments reflected the general shift from water to land sinks characteristic of the post-1945 period (Tarr, 1984). While water discharges continued, the concentration of hazardous materials in sludges and their land burial of those sludges had begun by 1970.

By the late 1970s, most industries relied on municipal treatment plants for the final treatment of their effluent. A 1978 inventory (SIMAPC, 1978) reported thirty of forty-three industries sent their effluent to local treatment works, and only a portion provided pretreatment (Table 3.1). Amax Zinc Corporation, a zinc refiner, provided lime neutralization and metals removal, while Monsanto removed mercury from its waste stream. Several hazardous material-handling

Table 3.1. **Reported Industrial Waste Treatment, 1978.**

Company	To Municipal Sewage Treatment Works: Pretreatment	To Municipal Sewage Treatment Works: No Pretreatment	On-Site Treatment
Arco		X	
Air Products & Chemicals		X	
Alton Box Board			X (?)
Amax Zinc	neutralization metals removal		
American Steel Foundries		X	
Amoco Oil			Primary
A.O. Smith		X	
Cerro Copper	primary settling		
Chemetco			Primary
Clark Oil	separator, activated sludge, dissolved air, flotation		
Conalco		X	
Diamond Plating		X	
Edwin Cooper		X	
Granite City Steel			lagoons, neutralization,
LaClede Steel			aeration, polymer addition, flow clarification
Lanson Chemical	solvent trap		
Midwest Rubber		X	
Monsanto Industrial Chemicals	mercury removal		
Morris Paint		X	
Musick Plating		X	
National Lead		X	
Olin			chemical treatment
Pfizer		X	
Roesch Enamel		X	
Shell	oil separators, lime, slurry absorption, dissolved air flotation, and retention basins		

Source: SIMAPC, 1978

industries provided no pretreatment before discharging their wastes into city sewers (SIMAPC, 1978). In contrast, thirteen industries provided complete treatment on site. These included the oil refineries, Granite City Steel, and Olin Corporation (SIMAPC, 1978). Thus, by 1978 effluent from all forty-three surveyed industries received some form of treatment. This meant the concentrations of hazardous materials released to streams was being reduced; but the volume of sludges and sediments was increasing.

The fact that numerous industrial waste streams received primary or even secondary treatment by the 1970s does not signify hazards were eliminated. The USEPA found that many "priority pollutants" are concentrated in treatment residues. Metals and solvents, in particular, are concentrated in both primary and secondary sludges (USEPA, 1974; see also Miller and Burch, 1981). Among the industries common in the East St. Louis area which generated hazardous sludges were oil refineries, electroplaters, and printing operations (Hunt, et al., 1984).

Although counties and municipalities throughout the region had ordinances requiring the operators of dumps and landfills to seek permits, older records have not been maintained. Thus the only reliable documentation of early land disposal relates directly to on-site industrial dumping rather than mixed municipal landfills. The steel mills (Laclede and Granite City) both created deposits of slag on site and these areas may have been used for the dumping of pickle and quench liquors (Rudolfs, 1953: 374). Monsanto created "toxic dumps" on site and American Zinc piled its sludge on site (IEPA, Div. Water Pollution, Monsanto Plan, 1945). Pre-1930 examples suggest the reclamation of factory property with solid wastes was extremely common, and dumping on site continued into the 1970s. A 1969 survey of landfills listed several manufacturers with disposal facilities on their own property. Included in this list were Granite City Steel, Owens-Illinois and Shell Oil (SIMAPC, 1969). Monsanto Chemical Company requested permission to use part of its property as a "sanitary landfill" in 1968. The company proposed to bury approximately 34,000 cubic yards of still residues, tars, by-products, waste solvents, and filter sludges from its East St. Louis and St. Louis operations (IEPA, IDPH Microfilm, Correspondence, 8/16/1968). Still another example of on-site accumulation of hazardous materials occurred at the Olin Corporation site in East Alton. Nearly seven million pounds of "nonusable explosive wastes" had collected at the old gunpowder plant between 1962 and 1970. The wastes included nearly one million pounds of rocket propellant which contained a large proportion of nitroglycerine (**ESL Journal**, 12/3/1970). Earlier that same year, Olin had negotiated with the Department of Public Health to dispose of zinc oxide dust at the Barton Landfill, west of Edwardsville.

Better records are available for the period following the passage of the Illinois Refuse Disposal Law (1965), and they indicate the mixing of industrial and municipal wastes took place in remote sites and in wetland areas. One example is the Chouteau Island landfill (Fig. 3.3). Neighbors of the landfill complained to the Sanitary Water Board in 1965 that the operators were dumping "every conceivable kind of trash" in an old borrow pit. They feared their shallow wells would become contaminated. County officials reacted several years later by prohibiting the dumping of out-of-state trash, thus suggesting the problem lay with St. Louis sources not local ones. The dump continued to accept mixed rubbish and in 1968 a young boy was burned by chemical compounds dumped on the surface at the landfill. One year after the accident, the Chouteau Island Corporation applied for a permit to operate a toxic and chemical landfill at the site. Thus the remote island location continued to serve as a mixed refuse landfill site. Although less secluded, the Sauget landfill also received chemical wastes from Missouri and local industrial sources (SIMAPC, 1969: III-6).

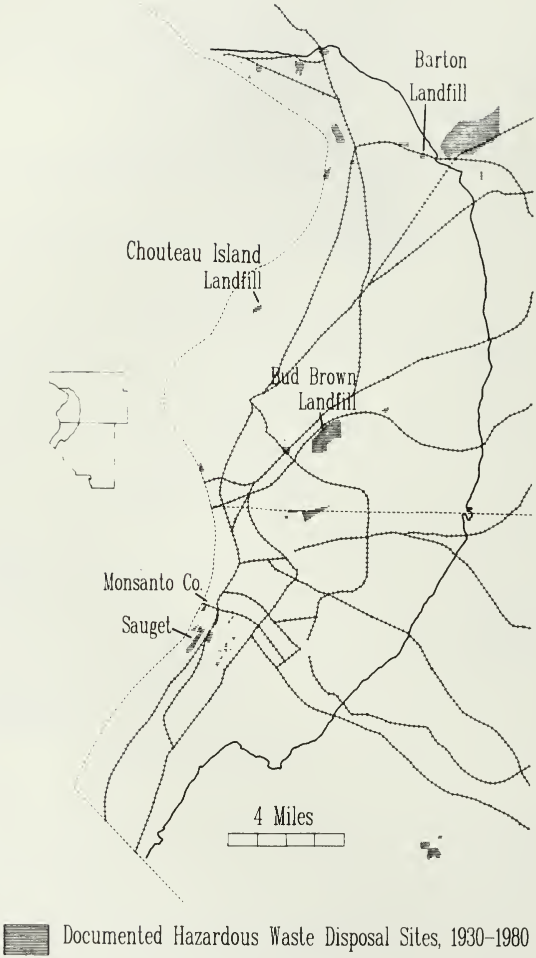


Figure 3.3. Documented Hazardous Waste Disposal, 1930-1980. Sources: ISWS, Groundwater Files; IEPA, Land and Water Division Microform Files; and additional sources mentioned in text.

Communities, private operators, and manufacturers pressed abandoned quarries and strip-mined areas into use as landfills. Several of the Sauget-area sites studied by the IEPA were originally excavated as sand and gravel pits. Contaminated ground water and mixed debris in the area suggests chemical wastes along with general urban refuse were mixed in the former quarries (Ecology and Environment, 1986). Alton converted a former clay pit north of town into a sanitary landifll in 1968 (SIMAPC, 1969), but no reports of industrial refuse being interned there were found. Several small upland communities used former strip mines as community landfills.

A third type of site favored for landfill activity has been the abandoned sloughs, creeks, and shallow lake beds on the American Bottoms. The Bud Brown landfill (Fig. 3.3), one of the more notorious landfills in the two-county region, exemplified this type of site. Located east of the intersection of Interstate Highway 55 and Route 203, Brown owned five tracts of land that were naturally low ground or had been used for borrow pits during the construction of the interstate highway. He acquired them during 1966 and used the property as landfill sites. Before he acquired the property, the land was used as "rebel dumps" since at least 1964, and neighboring radio broadcast stations complained of uncontrolled fires at the sites. During his operation of the sites, Brown accepted toxic and chemical wastes, along with putrescible rubbish and construction debris (IEPA, Div. of Land Pollution Files, IDPH Microfilm, Misc. Correspondence and Newspaper Clippings). Steps were taken, unsuccessfully, to close the Brown dump, and much of the area today remains in use as a landfill. Hundreds of acres of wetland have been filled over the course of the past twenty years.

A final source of industrial hazards has been air pollution. As noted before 1930 in the vicinity of smelters, airborne contaminants can damage vegetation and cause health problems to humans. During the 1930s and 1940s, renewed efforts to control the smoke nuisance were initiated. Law suits filed by private citizens against chemical companies and primary metal smelters reflect public reaction to industrial emissions. Lillie Wheatley complained that Monsanto Chemical was negligent in releasing gases and chemical substances into the atmosphere which caused respiratory problems. She brought a suit against Monsanto, citing a state nuisance ordinance and won a favorable ruling in the local circuit court in 1938 (Wheatley v. Monsanto, St. Clair Circuit Court, Case 3093). Several farmers in the vicinity of East St. Louis argued before the St. Clair Circuit Court that "various chemicals and acids" released by the American Zinc smelter damaged their crops between 1933 and 1937 (Bertels, et al. v. American Zinc, St. Clair Circuit Court, Case 3203). While it was difficult to prove a specific industry was culpable for low crop yields, the actions of the plaintiffs indicate growing public dissatisfaction with industrial air pollution and the perception that factory emissions were harmful.

Public opposition to smoke forced politicians to enact regulations in St. Louis. The Missouri city passed an anti-smoke law in 1937 which called for washing of low-grade Illinois coal and the establishment of a Smoke Commission (**St. Louis Post Dispatch**, 2/11/1937). The goal of the Commission was to reduce the amount of smoke produced by industry, railroads, and domestic coal-burning furnaces, although it was not immediately successful. Some manufacturers objected to the law, and, as might be expected, Illinois coal producers strenuously objected. The Belleville Chamber of Commerce even courted Missouri industries, citing the lack of "inhibitive smoke ordinances" as a reason for relocating to Illinois (**St. Louis Globe Democrat**, 1/21/1937). Smoke accumulations persisted, particularly during the fall when inversions are most common in the St. Louis area (St. Louis Globe Democrat, 11/22/1937 and 12/11/1940). The lingering problem prompted the city to pass a more stringent anti-smoke measure in 1940, which was hailed by the mayor as the "greatest single thing we have ever done in St. Louis" (**St. Louis Post Dispatch**,

4/8/1940). Although the achievements of the anti-smoke ordinances were not immediately recognizable--in fact one company moved its operation to Indiana because it could not assemble its electric motors in smokey conditions (St. Louis Post Dispatch, 12/11/1940)--there were significant reductions in the level of atmospheric pollution by the 1950s (USHEW, 1966: 5). Several technological developments augmented the smoke ordinances in achieving these results. Not only was lower-sulfur coal burned, but the adoption of diesel locomotives and increasing use of electricity and natural gas to heat homes further enhanced the legislative approach to air pollution control.

While the seasonal pall of smoke has largely been eliminated, evidence of lingering effects of air pollution suggests urban industrial pollution can contribute to surface water pollution. Schicht and Huff (1975) measured an unusually large zinc ratio in surface water taken from Indian Creek, leading them to conclude that atmospheric pollution was the source. Other metals and persistent chemicals may exist in areas downwind from industrial sources of pollution (USEPA, 1985).

3.3 Conclusions

Throughout the greater part of the past half century, there was very little industrial waste treatment. Large quantities of factory effluent flowed through sewers into the Mississippi River and on toward the Gulf of Mexico. There were other water repositories which were less efficient in removing factory effluent from the region. Grassy Lake, Dead Creek, Horseshoe Lake, Pittsburg Lake, and quite likely Smith Lake received industrial effluent which simply accumulated *in situ*. Given the common waste management practices and the frequent choice of low wetlands as industrial dumping sites, all former lakes and stream channels downgradient from or in the vicinity of hazardous waste sources, past or present, are possible repositories of hazardous materials.

Solids, while less likely to be transported than liquids, are also scattered widely across the American Bottoms. Most industrial sites have been raised by on-site dumping of industrial solids and nearby low areas also received slags, sludges, and mixed urban and factory refuse. The use of landfills as combined municipal and industrial waste disposal grounds, and the nature of much of the chemical wastes produced in the East St. Louis area, make any former landfill site suspect.

CHAPTER 4 - ANALYSIS, CONCLUSIONS, AND RECOMMENDATIONS

The historical juxtaposition of industry and human communities creates several scenarios of possible exposure to hazardous materials. One such situation is the airborne releases of smoke and gases which can affect people downwind from the source. Exposures of this nature are generally shortlived, although deposition of airborne contaminants can occur (Schicht, 1977). Land accumulations of hazardous solids can affect human populations through the release of toxic or explosive gases, contamination of water supplies, or direct contact. Liquid hazards can taint either surface- or ground-water resources, although any of the possible means of exposure require a human presence or use of a contaminated resource. The extensive surface alteration of the American Bottoms, along with population increases after the peak of industrial activity, created situations whereby humans and human activities could have intruded on former zones of accumulation. This chapter will examine a series of maps contrasting waste disposal practices with human use of the study area. This analysis will provide clues to possible past, present, or future exposure to relict hazards.

It must be emphasized that the delimitation of zones of possible exposure does not reflect actual exposure. It merely indicates zones where the conditions for possible exposure existed at some time or may exist in the future. Also, the data used to build the maps for this section are imperfect. Thus, there may be additional zones which are not depicted here.

4.1 Accumulations and Changing Land Uses

Both the sharp break in gradient from the bluffs to the floodplain and the gentle relief of the American Bottoms produced conditions allowing waterborne sediments to accumulate by natural processes. The topography of the floodplain also created ideal locations for the disposal of human wastes. In 1900 there were numerous channels draining the American Bottoms, but the drainage pattern was poorly developed and stream currents were observed to change direction (Helm, 1905). Most streams crossing the Bottoms either flowed into or out of one of the numerous shallow lakes which covered extensive portions of the floodplain (Fig. 4.1). Given these conditions, sedimentation in the form of alluvial fans at the base of the bluffs and small deltas in the bottom-land lakes formed due to the inability of streams to carry a sediment load across the gentle gradient of the floodplain (Hill, et al., 1981). With the formation of the East Side Levee and Sanitary District in 1907, the large-scale disruption of natural drainage commenced. As drainage districts carved new channels across the Bottoms, they left abandoned channels and efficiently diverted upland runoff from the lakes on the floodplain. The loss of surface water in lakes was accelerated by industrial pumpage of ground water, which lowered the water table beneath the major industrial centers. Jointly, these two main human influences reduced the natural lake area of the American Bottoms by more than 40 percent (Bruin and Smith, 1953). Both the former channels, (such as Dead Creek, Wood River, and Cahokia Creek) and lakes (including Smith, Grassy, Horseshoe, and Pittsburg Lake) received sewage and/or solid wastes from municipalities and industries. Severed from their ultimate outlet, or used as final sinks themselves, these topographic depressions became repositories of wastes--some hazardous, some not. There has been little direct encroachment of urban land uses on these former water bodies, but humans live alongside Dead Creek and near reclaimed portions of Pittsburg Lake (Fig. 4.2).

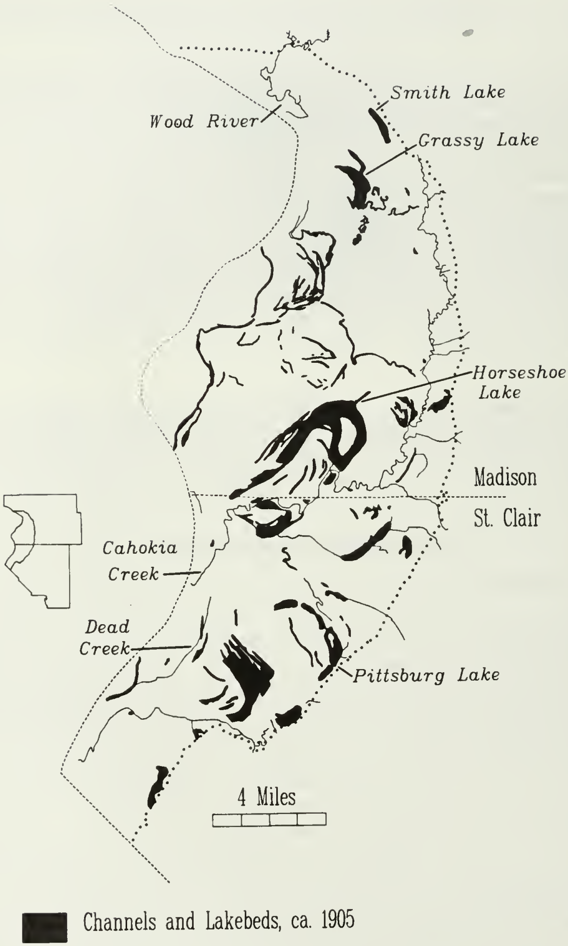


Figure 4.1. Natural Drainage Pattern of the American Bottoms, ca. 1905. Sources: ESL&SD Maps, Wood River Levee District Maps; USGS Topographic Maps.

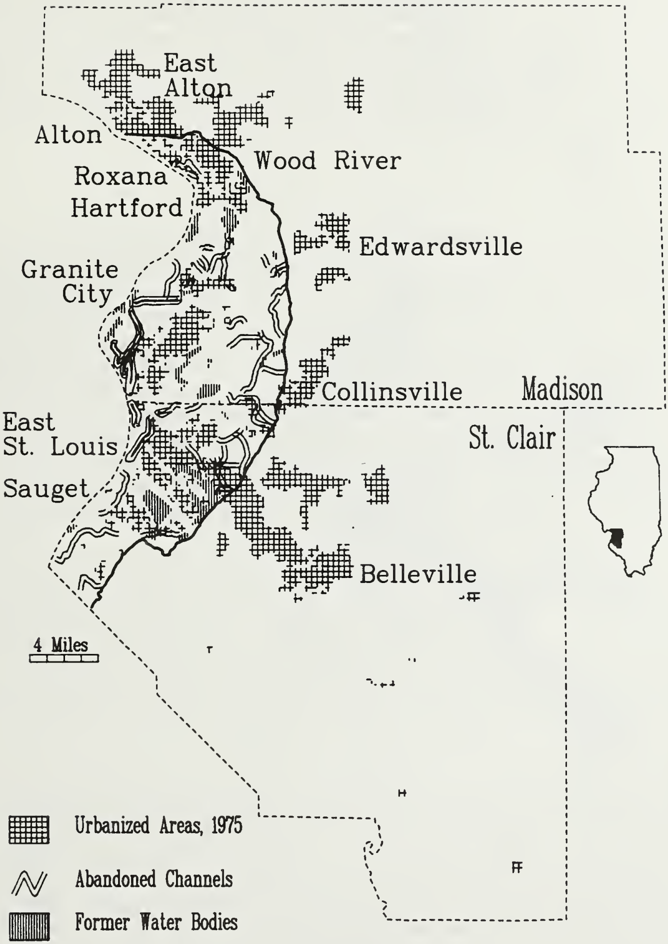


Figure 4.2. Areas of Possible Urban Encroachment on Zones of Accumulation.

Other accumulations occurred in the form of documented disposal of wastes (Fig. 4.3). Subsequent urbanization has created few intrusions on disposal sites. Near Wood River some overlap occurs, the former lead smelter site northeast of Collinsville is now a residential subdivision, and residential construction in Sauget has occupied former disposal grounds (E&E, 1986). The limited amount of residential intrusion on former waste sites indicates reclaimed land has not been perceived as useful for all purposes. Thus, there has been a small amount of the direct, long-term exposure that would be most common among people living directly over a waste site.

4.2 Possible Indirect Exposure

One possible method of human consumption of hazardous substances is ingestion of contaminated ground- or surface-water. Most of the communities on the American Bottoms rely on an interurban water supply system which draws from the Mississippi River; this system also supplies a number of upland communities (cf. Figs. 4.4 and 4.5). Through the 1950s there were frequent reports of phenolic and oil releases into the Mississippi River and the managers of the East St. Louis water plant frequently voiced their objections to the foul tasting water which resulted from discharges upstream. Customers of the water systems were exposed to industrial wastes in a diluted form, although consumption was intermittent. Delivery of tainted water extended from Granite City to Dupo on the Bottoms and to Belleville, Shiloh, and O'Fallon on the uplands. More stringent controls on discharges in recent years and the installation of secondary treatment facilities have reduced the volume of pollution entering the Mississippi River. Thus, although the water delivery system supplied more customers in 1980 than in 1953 (cf. Figs. 4.4 and 4.5), the quality of surface water consumed has improved.

The extensive alluvial deposits of the American Bottoms are underlaid by sand and gravel drift deposits, generally less than fifty feet below the surface. These sand and gravel deposits are one of the principal aquifers in the state of Illinois (Shafer, 1985) and they are susceptible to contamination from the surface (Jacobs, 1971). Although the major population centers have relied on surface water for domestic consumption, several of the smaller communities on the American Bottoms and a number of upland towns pump their domestic water supplies from the shallow sand and gravel aquifers (Figs. 4.4 and 4.5). Wood River, Roxana, and Hartford each has relied on shallow wells since at least the 1920s (Hanson, 1950).

High volume industrial pumping in the vicinity has caused large cones of depression near these communities (Bruin and Smith, 1953; Schicht and Jones, 1962; and Collins and Richards, 1986). These cones of depression, potentiometric lows, form areas of diversion within which ground water tends to move toward the point of withdrawal. Leachate from surface deposits of hazardous materials within the areas of diversion could move toward points of withdrawal, and enter wells in the path of the subterranean plumes. In the early 1950s there was a potentiometric low beneath the Wood River oil refineries which had used Grassy Lake and on-site lagoons (some of which were lined) for disposal of waste products since the 1920s (Fig. 4.6a). In fact, one refinery was recovering refined petroleum products that leaked into shallow aquifers as a means of protecting the quality of the water it was pumping for use in refining operations. Thus, contamination was possible through the 1950s and there were several public water supply wells in the vicinity of the refineries. In recent years, the closure of one refinery (Amoco) and the tannery in Hartford has reduced the volume of possible contaminants. Yet, the existence of documented hazardous material accumulations and a persistence of a potentiometric low beneath the refinery district suggest close ground-water monitoring should be a priority in this area (Fig. 4.6a, b).

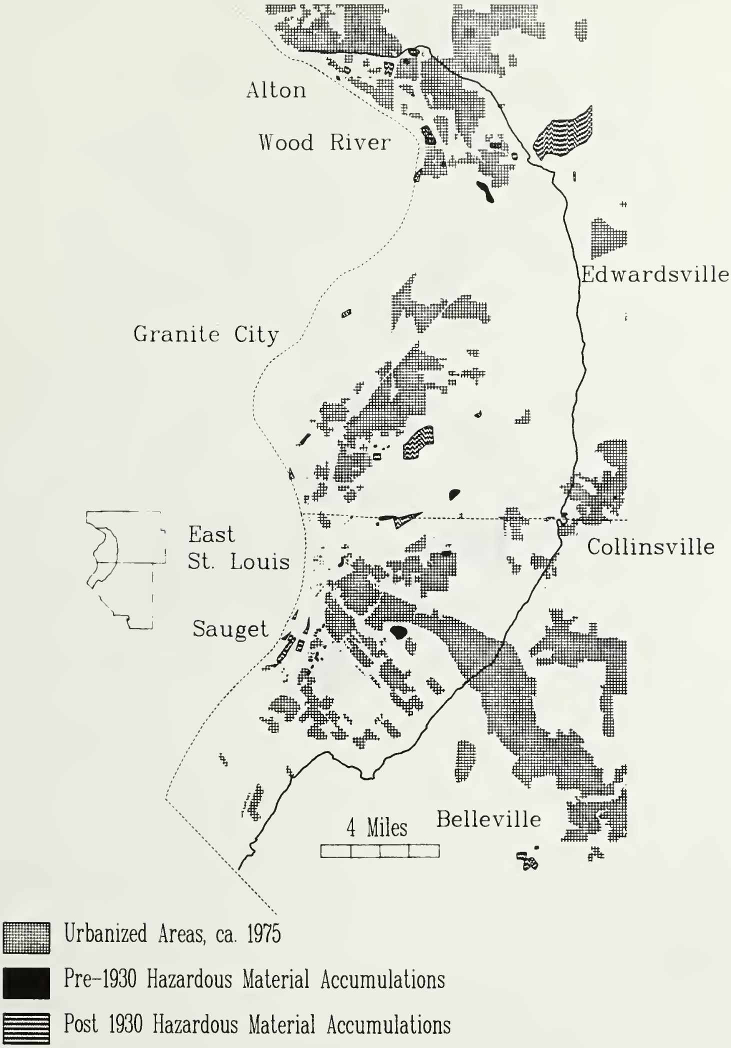


Figure 4.3. Urbanized Areas, ca. 1975 and Areas of Documented Hazardous Material Disposal, 1890-1980.

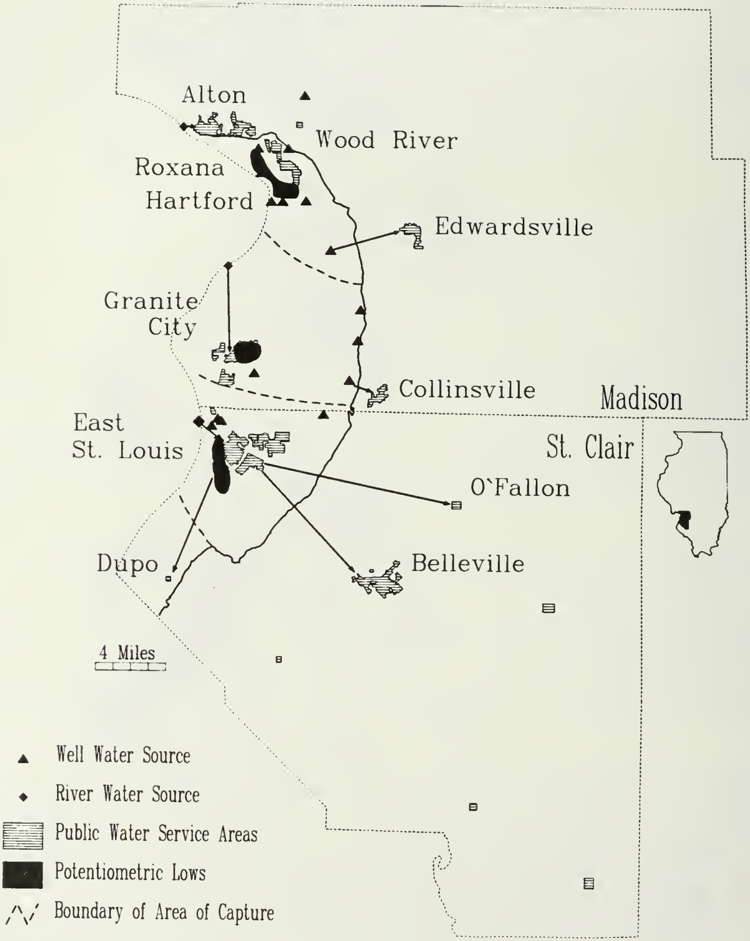


Figure 4.4. Public Water Service Areas and Potentiometric Surfaces, ca. 1953. Sources: Bruin and Smith, 1953.

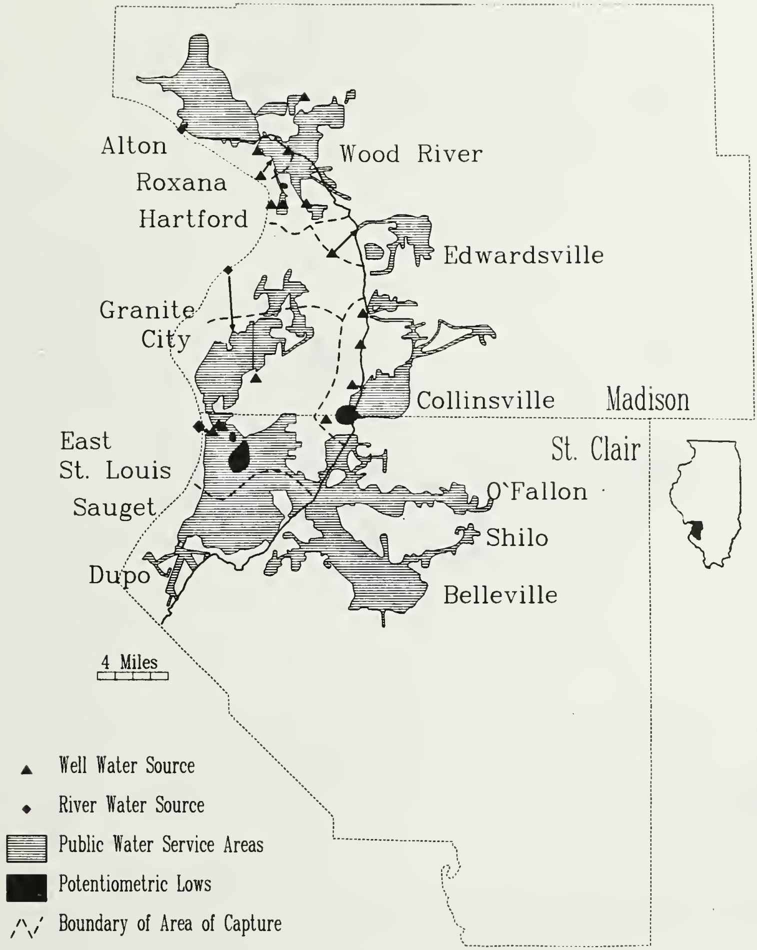


Figure 4.5. Public Water Service Areas and Potentiometric Surfaces, ca. 1980. Source: Collins and Richards, 1986.

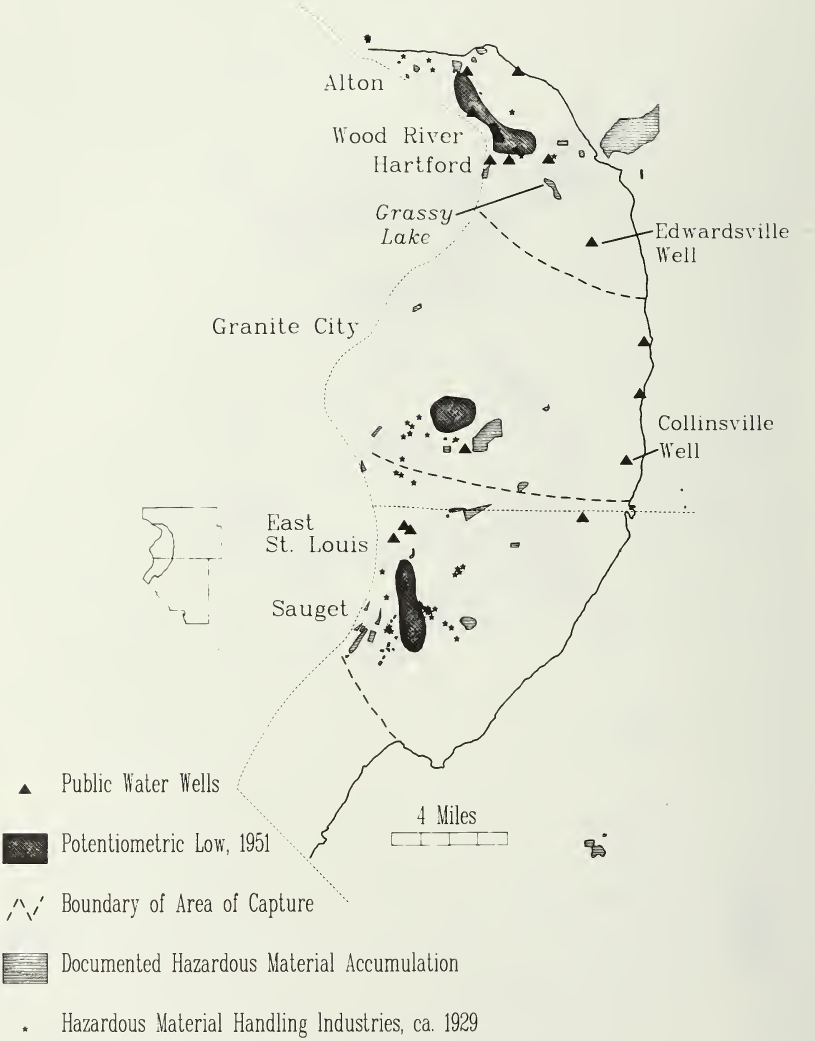


Figure 4.6a. Documented Hazardous Material Disposal Sites 1890-1980 in Relation to Areas of Diversion and Potentiometric Lows 1951 and Public Water Supply Wells. Source: Bruin and Smith, 1953.

Figure 4.6b. Documented Hazardous Material Disposal Sites 1890-1980 in Relation to Areas of Diversion and Potentiometric Lows 1980 and Public Water Supply Wells. Source: Collins and Richards, 1986.

Upland communities with wells drilled into the sand and gravel aquifers (Edwardsville and Collinsville) are less likely to have pumped contaminated water in the past. Local ground-water movement has been dominated by the cone of depression created by the industrial districts between the wells near the bluff line and the Mississippi River. A general ground-water movement away from the bluff toward the potentiometric lows would have minimized the possibility that upland residents consumed leachate from documented hazardous material disposal sites in the 1950s and the 1970s (cf. Figs. 4.4, 4.5, and 4.6a, b). Industrial pumpage has declined from more than 70 million gallons a day in 1971 to under 44 million gallons daily in 1980 (Collins and Richards, 1986). If the water consumption of bluff communities increases in the future due to population increases while industrial pumpage declines, diversion of contaminants into municipal wells could occur. For this reason, monitoring of the shallow wells used by upland communities should be initiated.

A comparison of rural domestic wells and documented disposal of hazardous substances indicates that monitoring of domestic wells in the census tract surrounding Horseshoe Lake is advisable, as well as the tract south of Wood River (Fig. 4.7). Several incidents of disposal have been documented in these tracts where there are large numbers of domestic well users. Ground-water monitoring in the vicinity of Scott Air Base should also commence.

The highest population densities in the county are in the urbanized areas and not in the zones with large numbers of domestic well users (cf. Figs. 4.7 and 4.8). Thus, larger numbers of residents can be served by monitoring public water supplies. This does not preclude the need to establish a monitoring system to serve the rural areas.

4.3 Conclusions

In the case of Madison and St. Clair counties, the historical record provides some valuable information about hazardous material management during the past century. While the record is imperfect and incomplete, it complements the data assembled by regulatory agencies (USEPA and IEPA) and suggests that more detailed information is available at the local level. Retrospective analyses of industrial districts can yield substantive information which can be applied to hazards assessment at the local, state, and national level.

Specifically, the information contained in this report provides several insights into waste management within the two-county region. Industrial activity was more widespread in 1929 than in 1980, both in terms of the area devoted to industrial land uses and the number of manufacturing concerns handling hazardous materials. The contraction of industrial activity between 1930 and 1980 removed numerous possible sources of hazardous materials from current inventories, thereby causing the existing databases to underrepresent the number of past sources of hazards. Waste management at these previously undercounted industries was largely absent prior to the 1950s, with a few exceptions. Factories dumped all manner of liquid wastes into water courses for natural purification and dilution treatment, while they heaped solids on site. This created numerous water sinks, including most of the lakes and stream channels on the American Bottoms, where sediments were allowed to accumulate over the years. Factory sites also became repositories of a mixture of hazardous and non-hazardous wastes. In brief, the sites of all former hazardous material handling industries and any abandoned channels or lakes nearby are likely hazardous locations.

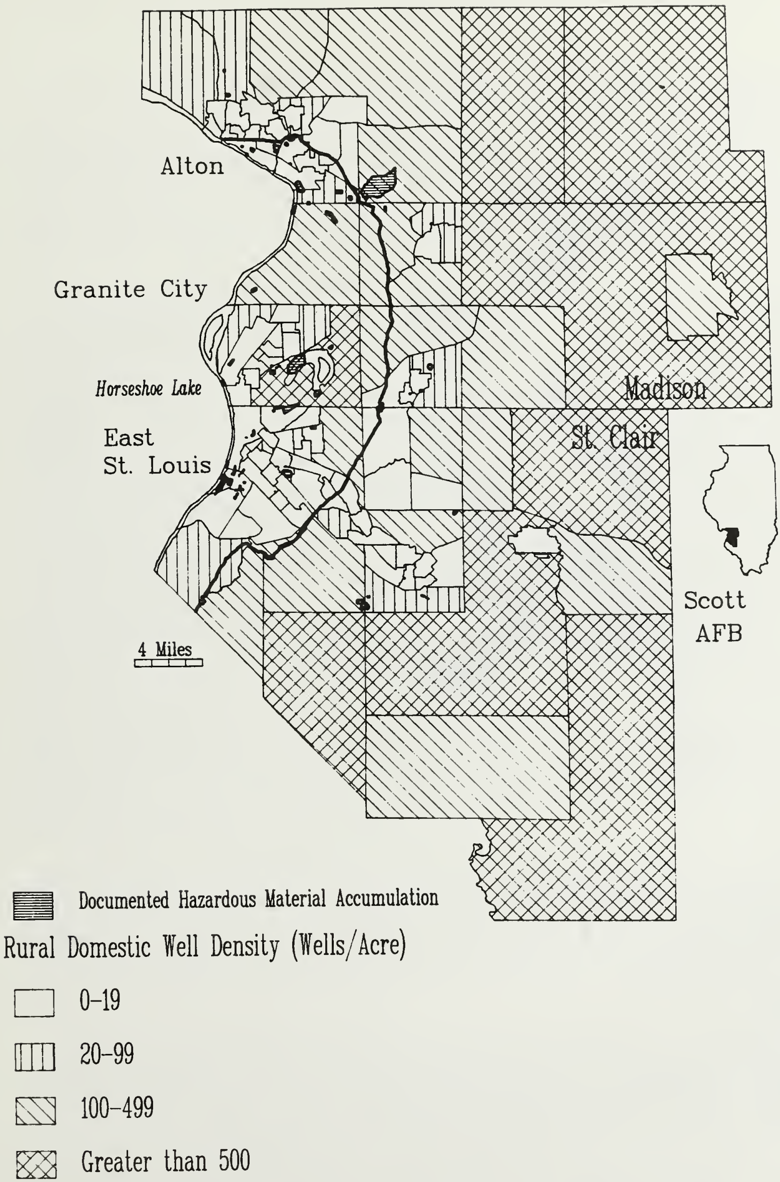


Figure 4.7. Documented Hazardous Material Disposal Areas and Domestic Well Density. Source: U.S. Census, 1980.

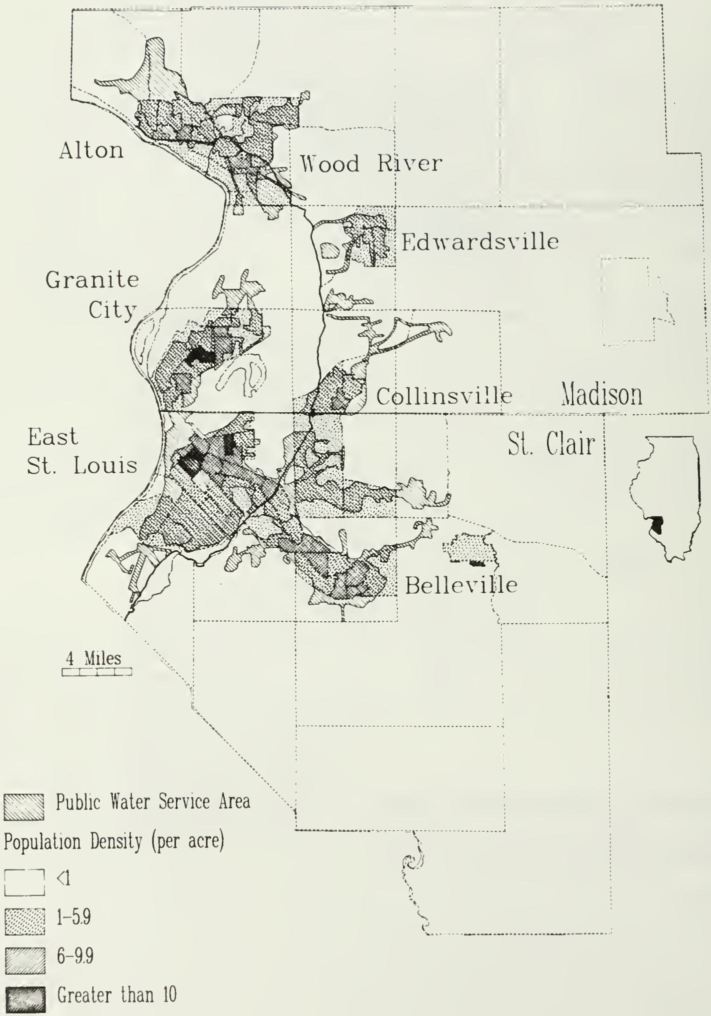


Figure 4.8. Public Water Supply Areas and Population Density by Census Tract, 1980. Source: U.S. Census, 1980.

From the 1930s on, manufacturers in the two-county area responded to pressure from environmental agencies and gradually added waste treatment facilities. While the addition of waste management equipment may have been slow to occur and in some cases inadequate, it represented moderate efforts to comply with state and federal legislation. Furthermore, on-site treatment facilities were designed to handle the specific effluent of a given industry, thus they provided superior treatment than the sometimes erratic service offered by some of the municipal treatment plants. However, the accumulation of sludges on-site or the transfer of treatment facility wastes to land repositories presents a continuing problem.

In terms of state-wide hazardous waste inventories, this report offers four observations. First, the HWRIC database does not adequately represent the long-term activities of hazardous material-related industries in the Madison-St. Clair county area. Decennial analysis of industrial closures presented patterns resembling those found in the **County Business Patterns**, but the date of inception for many of the large manufacturers fails to account for the complete history of activity in the area. This does not suggest that similar shortcomings exist for other counties--to determine that would require a detailed examination on a county-by-county basis--but it does indicate that the database shares some of the historical weaknesses of its sources. Its utility for analysis of hazards-related activity during the past three decades would be superior to use of the database for long-term retrospective analysis. Second, the Illinois State Geological Survey landfill inventory also presented slight difficulties for use as a historical reference. Two of the major landfills, Bud Brown and Chouteau Island, could not be identified in the current inventory by their former names. Historical information is lacking for many of the landfills, thus decreasing the inventory's utility to cross reference current landfill activity with past owners and events. While not a major flaw, it diminishes the historical usefulness of the database. Third, the identification of a large zone of the American Bottoms as an area requiring high priority ground-water monitoring was supported by the historical information. Although industrial activity in Madison and St. Clair counties has contracted during the past half century, there has been relatively little redevelopment of industrial tracts. Thus, in the case of the American Bottoms, recent information has provided a workable guide to the location of hazardous material sources. Finally, archival sources helped reconstruct the industrial, waste management, and surface alteration histories of the study area. This information can be used to improve the contents of the state-wide inventories, but only through intensive research efforts.

In the context of urban development, Madison and St. Clair counties provide a clear example of the conflicts among political forces, manufacturing interests, and public health authorities. The fragmented political structure of the American Bottoms allowed industries to establish waste management practices which were outlawed in adjoining towns, thereby creating tensions and unsafe health conditions. Continuation of casual disposal practices, fostered by the small community subdivisions, rendered many of the low-lying areas useless as recreational or residential areas.

Manufacturers generally saw their landfilling activity as a useful function. Land which was available for industrial activity in 1890 was generally poorly suited to low-capital investment, such as housing. Manufacturers producing large volumes of solid wastes could economically utilize such tracts of land by filling in depressions on their own property, thereby expanding the area of usable land. Once established, industries exerted a major influence over the local regulation and enforcement of public health issues.

Capital-intensive development was dependent on government-supported improvements, whether river navigation projects or local flood control and sewage treatment. Extensive suburban industrial development required the support of large-scale public works improvements, and the form taken by publicly supported improvements was, to a large measure, shaped by the interests of manufacturers and not by the public health interests of the community.

As in other locales (Rosen 1986), the urbanization of the American Bottoms between 1890 and 1980 showed significant lags between demands for public works and their installation. There was also a delay between the need for improved hazards management and the implementation of such improvements. As a consequence, some accumulations became common-place, self-perpetuating land uses, thereby deferring other forms of development.

4.4 Recommendations

1) The Madison-St. Clair County area is an excellent choice for the implementation of a pilot ground-water monitoring program. This program should be vigorously pursued, particularly in the vicinity of a) pre-1980 landfills which handled mixed hazardous and non-hazardous wastes, b) all former local-gas works, c) abandoned creosote and primary metal processing works, d) public water supply wells drilled into the sand and gravel aquifers beneath the American Bottoms, and e) areas near industries that have practiced on-site disposal.

2) The HWRIC should work closely with existing industries to reduce further accumulations and to provide more detailed documentation of past waste management activity. Attempts should be made to examine the manufacturers' records of past waste disposal and to encourage removal of on-site hazardous material accumulations. Technical assistance should be offered to facilitate waste reduction efforts.

3) Attention should be paid to landfills and abandoned dumps above the major cones of depression. Water tables in these areas are rising, and may continue to rise. This could saturate landfills which are currently above the water table giving the contents unimpeded access to the ground-water system. Older landfills with mixed contents should be examined for possible future saturation.

4) Methods for enhancing the historical utility of the HWRIC-supported databases should be considered.

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